OBSERVATIONS

ON THE

FUR SEALS OF THE PRIBILOF ISLANDS.

PRELIMINARY REPORT

BY

DAVID STARR JORDAN,
President of Leland Stanford Jr. University,
COMMISSIONER IN CHARGE OF FUR SEAL INVESTIGATIONS FOR 1896;

AIDED BY THE FOLLOWING:

LEONHARD STEJNEGER AND FREDERIC A. LUCAS,
Of the U. S. National Museum.

JEFFERSON F. MOSER,
Lieutenant-Commander, U. S. N.,
In Command of the Fish Commission Steamer Albatross.

CHARLES H. TOWNSEND,
Of the U. S. Fish Commission.

GEORGE A. CLARK,
Secretary and Stenographer.

JOSEPH MURRAY,
Special Agent.

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LETTER OF TRANSMITTAL.

Hon. JOHN G. CARLISLE,
Secretary of the Treasury.

DEAR SIR: I have the honor to transmit to you the following preliminary report on investigations on the fur seal in Bering Sea, made in the summer of 1896, in pursuance of an act of Congress, as follows:

"*Resolved by the Senate and House of Representatives of the United States of America in Congress assembled,* That the Secretary of the Treasury be, and is hereby, authorized to expend, from any moneys in the Treasury not otherwise appropriated, a sum sufficient to provide for the employment of persons to conduct a scientific investigation, during the fiscal years eighteen hundred and ninety-six and eighteen hundred and ninety-seven, of the present condition of the fur-seal herds on the Pribilof, Commander, and Kurile islands in the North Pacific Ocean and Bering Sea, said amount not to exceed for both said years the sum of five thousand dollars.

"The Secretary is also authorized to employ a stenographer in connection with this investigation at a rate of compensation not exceeding one thousand five hundred dollars per annum, and to pay his compensation and expenses out of any moneys in the Treasury not otherwise appropriated.

"The President is authorized to detail, for the purposes of assisting in this investigation, any officer or officers or employees of the United States Government, their actual expenses and the expenses of the person or persons employed under the preceding paragraph to be paid by the Secretary of the Treasury out of any moneys in the Treasury not otherwise appropriated.

"The President may detail a vessel of the United States for the purpose of carrying out this investigation."

In accordance with the act above quoted, I was appointed to take charge of the investigation of the fur seals on June 18, 1896. Mr. Joseph Murray, of Fort Collins, Colo., formerly United States Treasury agent at St. Paul Island, was selected as assistant, and the following persons from the United States National Museum and the United States Fish Commission were detailed as associates: Lieut. Commander Jefferson F. Moser, commanding the United States Fish Commission steamer *Albatross;* Dr. Leonard Stejneger, curator of reptiles, United States National Museum; Mr. Frederic A. Lucas, curator of comparative anatomy, United States National Museum, and Mr. Charles H. Townsend, naturalist of the *Albatross.*

In accordance with the provisions of the act above quoted, Mr. George Archibald Clark, president's secretary at Leland Stanford Junior University, was appointed secretary and stenographer to the investigation, and by the faithfulness and accuracy of his natural history observations, as well as by his stenographic skill, he has contributed very largely to the success of the work.

I can not speak in too high terms of the zeal with which Messrs. Stejneger, Lucas, and Clark gave themselves to the trying work involved in this investigation. To their desire for absolute accuracy in all details, and to their energy in carrying out the work assigned to them, the success of the investigation may be chiefly attributed. As commander of the *Albatross,* Captain Moser was of the greatest service to the Commission, his deep interest in the work, his extensive hydrographic knowledge, and his excellent seamanship, being factors of great importance. The work assigned to Mr. Townsend was executed with his accustomed care and accuracy, and the practical knowledge of Mr. Murray proved of great value. The continuous and efficient interest of Assistant Secretary Charles S. Hamlin in these and all other matters pertaining to Alaska has been a large element in the success of our work.

Series of similar investigations were carried on at the same time by Prof. D'Arcy W. Thompson, of the University of Dundee, and Mr. Gerald E. H. Barrett-Hamilton, of Dublin, commissioners for Great Britain, and by Mr. James M. Macoun and Mr.

Andrew Halkett, of Ottawa, commissioners for Canada. These investigations were independent of those under my direction, but all results obtained by us were placed fully and freely at the disposal of the foreign commissioners, and like courtesies were extended to us by them in return.

I have further to acknowledge indebtedness for favors or assistance of one sort or another received from the following persons:

Mr. Joseph B. Crowley, special, and Messrs. James Judge and Thomas E. Adams, assistant, Treasury agents on the islands; Capt. C. L. Hooper, commanding the Bering Sea patrol fleet; Capt. W. H. Roberts and officers of the United States revenue cutter *Rush;* Capt. H. D. Smith and officers of the *Perry;* Capt. W. D. Roath and officers of the *Corwin;* Capt. Francis Tuttle and officers of the *Bear,* and Capt. J. A. Slamm and officers of the *Grant;* Messrs. Garrett, Parmenter, Dubois, and other officers of the *Albatross,* and Mr. N. B. Miller, assistant naturalist on board the same vessel; Mr. Joseph Stanley-Brown, superintendent, and Messrs. J. C. Redpath, Daniel Webster, E. J. Baldwin, Harry Chichester, and Captain Nice, employees of the North American Commercial Company on the Pribilof Islands and at Unalaska, and Drs. Otto Voss and L. A. Noyes, the company's resident physicians on St. Paul and St. George; Capt. Albert C. Allen and officers of H. M. S. *Satellite,* and Capt. F. A. Garforth and officers of H. M. S. *Pheasant;* Col. Nicholas Grebnitzi, then governor of Komandorski; Major Waxell, governor of Medni Island, and Mr. Emil Kluge, agent of the Russian Fur Seal Skin Company on Bering Island.

The general report of the observations of the summer will appear later, and will be of a monographic character, illustrated by charts and plates. The present preliminary report deals briefly with the practical questions involved in the investigation, and particularly with answers to the questions asked in the letter of instructions from the Acting Secretary of the Treasury. The following is the full text of this letter:

TREASURY DEPARTMENT, OFFICE OF THE SECRETARY,
Washington, D. C., June 13, 1896.

DR. DAVID S. JORDAN,
Palo Alto, Cal.

SIR: Further instructing you as to the scientific investigation to be made by you of the present condition of the fur-seal herds on the Pribilof, Commander, and Kurile islands, I have the honor to state that Prof. D'Arcy W. Thompson and Mr. James M. Macoun have been designated by the British Government and Canadian government, respectively, to make an independent investigation relative to the same subject. Having found it impracticable to rely upon the ordinary means of reaching the fur-seal islands, they have been offered, and have accepted, transportation and accommodations on board the steamer *Albatross,* and will be granted the same facilities as yourself and party for conducting their independent investigations. As regards the investigation on behalf of the United States Government, you are charged with the arrangement of the details both of the field work and of the work to be performed by the gentlemen designated to assist you, reliance being placed upon your judgment to utilize to the best advantage the means supplied for accomplishing the objects of the expedition. You are authorized to direct the members of your party to act conjointly with you on all matters, or you may assign them severally to the study of separate subjects, or to different localities, as you consider most expedient. The advisability is suggested for your consideration of sending one of your party upon the *Albatross* to the Kurile Islands and Robben Island. Should you need transportation by vessel during such absence of the *Albatross,* the commander of the Bering Sea patrol fleet, Captain Hooper, will be instructed to render you every facility.

Your final report will be expected to relate more specifically to the group of seals which resort to the Pribilof Islands, but the Asiatic herd may be investigated to such extent as seems advisable in order to afford the opportunity for instituting comparisons from which important deductions may be reached.

The principal object of this investigation is to determine by precise and detailed observations, first, the present condition of the American fur-seal herd; second, the nature and imminence of the causes, if any, which appear to threaten its extermination; third, what, if any, benefits have been secured to the herd through the operation of the act of Congress and act of Parliament based upon the award by the Paris Tribunal of Arbitration; fourth, what, if any, additional protective measures on land or at sea, or changes in the present system of regulations as to the closed season, prohibited zone, prohibition of firearms, etc., are required to insure the preservation of the fur-seal herd.

Your inquiries should furthermore be extended, in so far as the time and circumstances permit, to embrace the consideration of all important questions relating to the natural history of the seals, both at sea and on the islands, with special reference to their bearing upon the sealing industry.

Your attention is specially directed to the following questions, which should be treated in your report:

1. The effect of pelagic sealing in the North Pacific Ocean and Bering Sea upon the fur-seal herd, due account being taken of the classes of seals killed.

2. What effect, if any, has the annual removal of bachelor seals, which has taken place on the Pribilof Islands, had upon the fur-seal herd?

The solution of these two questions involves a study of the entire subject of the regulations of the two sexes and the proportion of the male seals required to be preserved in order to maintain the stability of the herd.

3. Whether killing on land or sea has interfered with the regular habits and occupation of the islands by the herd, or has operated to reduce the strength of the seal race as a whole by a natural selection.

4. The propriety of existing methods of driving seals from the hauling grounds to the killing grounds, culling, and other practices connected therewith.

5. The cause of the destruction of nursing pups upon the islands.

During the seasons of 1894 and 1895 about 20,000 and 30,000 dead pups, respectively, were found upon the islands. You should specially consider the causes of their death, whether from starvation or other cause, preserving specimens whenever practicable.

6. The extent, date, and cause of mortality on the islands of seals of all classes.

7. The breeding habits of the seals, with special reference to the age at which the females begin or cease to breed, and the frequency of the breeding, whether annually or at longer intervals.

8. The condition of female seals taken at sea, as to nursing and pregnancy.

9. The distance which the several classes of seals go from the islands and the directions which they take in search of food or rest at different times during the season.

10. The actual decrease, if any, in the number of seals in each class on the Pribilof Islands which has occurred during the past year, and also since the year 1890, and since the year 1870. A careful census of the rookeries should be taken this season for comparison with the enumeration made in 1895 and previous years.

11. An examination of the question as to the character of the food of fur seals.

12. Whether the Pribilof Island herd of fur seals intermingle with the Asiatic herds of the Commander or Kurile islands.

13. Whether nursing seals nurse other than their own pups on the islands.

These latter questions are merely suggestions to guide you in your examination and report.

I have the honor to be, very respectfully, yours,

CHARLES S. HAMLIN,
Acting Secretary.

The questions here indicated are answered briefly in the present report, which deals mainly with the practical matters involved in the preservation of the fur seal.

I am, very respectfully, yours,

DAVID STARR JORDAN.

PALO ALTO, CAL., *November 7, 1896.*

OBSERVATIONS ON THE FUR SEALS OF THE PRIBILOF ISLANDS.

I. ASSIGNMENT OF WORK.

As the act of Congress above quoted contemplates a very extended investigation, the work has been divided among the members of the Commission as follows:

1. The general report; the diary of daily observations; detailed descriptions of the rookeries; hauling and killing grounds and drives; the starvation of pups, and the general movements of the seals on the islands—Dr. Jordan and Mr. Clark.

2. Anatomical studies; the causes of mortality among the seals; pelagic sealing from the natural history point of view; the historical sketch—Mr. Lucas.

3. The photographic work and maps; statistics of the pelagic catch; charts showing the distribution of the seals in Bering Sea—Mr. Townsend.

4. A study of the fur seal herds of the Commander, Kurile, and Robben islands; natural history and hydrography of Okhotsk Sea—Dr. Stejneger.

5. Hydrographic observations, and control of the *Albatross*—Captain Moser.

6. The oversight of certain practical experiments, the most important of them being the branding of fur seals—Colonel Murray.

II. ITINERARY.

The United States Fish Commission steamer *Albatross*, with the American Commission and Professor Thompson and Mr. Macoun, of the British Commission, left Seattle on the morning of June 24, arriving at St. George Island, Bering Sea, on the afternoon of July 8. July 9, 10, and 11 were spent in and about this island making general observations, photographing the rookeries, and counting the breeding seals. The time between July 12 and 18 was occupied in similar work on St. Paul Island.

July 18 the *Albatross* steamed for Unalaska, leaving Mr. Townsend there and taking Dr. Stejneger to the Commander Islands. July 30 to August 9 were spent about these islands, August 22 to 26 about the Kuriles, and August 28 to September 2 about Robben Island, reaching Hakodate, Japan, September 10.

On July 28 Mr. Lucas, Professor Thompson, and Colonel Murray visited St. George Island, the first two returning to St. Paul on August 5. Mr. Townsend returned from Unalaska August 8, and he and Mr. Lucas spent the time until the 12th at sea, on board the *Rush*, boarding vessels of the sealing fleet.

August 8 to 14, inclusive, were occupied in counting trampled pups on St. Paul. A similar count was made by Mr. Lucas and Mr. Macoun August 16 to 21 on St. George.

On August 16 Professor Thompson and Dr. Jordan left St. Paul Island in H. M. S. *Satellite* for the Commander Islands, spending August 21 and 25 on the rookeries of these islands and returning to St. Paul on September 1, bringing with them Mr. Barrett-Hamilton, another member of the British Commission.

Mr. Townsend left St. Paul on the company's steamer *Homer* for San Francisco August 23. Colonel Murray returned from St. George September 1, and on the following day made experiments in branding pups on Lukanin Rookery. Messrs. Lucas and Barrett-Hamilton spent September 2 to 5 at sea on the *Rush*, among the pelagic sealers.

On September 8 Dr. Jordan, Professor Thompson, and Mr. Lucas sailed with the *Rush* for Sitka and thence to Seattle, Messrs. Clark, Barrett-Hamilton, and Colonel Murray remaining on St. Paul.

On September 11 further experiments in branding were made. The starved and starving pups on St. Paul were counted September 28 to October 1. A similar count was made on St. George October 6. On October 7 Messrs. Clark and Macoun returned to St. Paul, Mr. Barrett-Hamilton remained on St. George, and Colonel Murray went to Unalaska. On October 22 the remaining commissioners left the islands on the *Bear* and arrived in Port Townsend November 3.

III. THE FUR-SEAL CALENDAR.

ased upon the records in the log, 1872–1896, and on observations made the present season.]

Close season for pelagic sealing begins May 1 and ends July 31.
Arrival of first bulls ranges between April 15 and May 6.
Arrival of first bachelor, March 1 to May 14.
Arrival of mass of bulls, May 15 to June 1.
Arrival of first cows, June 5 to June 16 (one season May 17).
Birth of first pup, June 10 to June 18 (one recorded May 21).
First food drive, April 30 to June 4 (one recorded March 17; two in February).
Rookeries at their height, July 6 to 16.
Birth of majority of pups, June 10 to July 1.
Greatest death rate of trampled pups, July 1 to 10.
Pups begin to pod, June 20 to July 1.
Arrival of first 2-year-old cow, July 27.
Formation of harems of 2-year-olds, July 30 to August 10.
Last drive for skins takes place July 14 to August 4.
Arrival of first yearling cow, August 1.
Arrival of body of yearling females, August 10 to 15.
Pelagic sealing begins August 1.
Pups begin to swim July 27 to August 5.
Bulls grow mild so that rookery can be entered, August 5 to 15.
Last pup born, August 14.
Best time to count pups, August 15 to 20.
Last food drive, December 6 to February 8.
Last copulation noticed, August 27.
Pups begin to die from starvation through pelagic sealing, August 10 to 15.
Bulls begin to leave, August 5 to September 1.
Seal fur is stagy, August 15 to October 20.
Idle bulls enter rookeries, August 5.
Formation of false harems by half bulls, August 10 to 20.
Pups swim long distances from rookery, August 26 to September 15.
Pups begin to turn gray, September 1 to 8.
Best time to brand pups, September 10 to 20.
Adult bulls return from feeding grounds, September 15 to 20.
Starved pups all dead, October 20.
Pelagic sealing ends, September 15 to October 1.
Weaning of pups, time of departure.
Departure of cows, November 5 to 15.
Departure of pups, November 5 to 15.
Departure of bulls, when winter drives them.
Departure of half bulls, when winter drives them.
Departure of bachelors, when winter drives them.

IV. THE FUR SEAL, OR SEA BEAR.

The "fur seal" or "sea bear," known in science as *Callorhinus ursinus*, is resident only on certain islands in Bering and Okhotsk seas, all of these islands having been unknown to aboriginal man, and none of them having been visited by man so far as known before the discovery of Bering and Medni islands by Vitus Bering in 1741, and that of St. George Island by Gerassim Pribilof in 1786.

The species known as the "fur seal" forms three distinct herds, which do not intermingle with each other in any way, the individuals of each type being distinguishable from the others by several characters of importance.

THE THREE HERDS.

The most important of these is the American or Alaskan herd living on the two islands of the Pribilof group—St. Paul and St. George. Next to this comes the Russian herd of the Komandorski or Commander islands, Bering and Medni (Copper) islands. The third herd is that of Okhotsk Sea, resident on Robben Island, where a remnant still remains, and formerly having rookeries also on three islands of the Kurile group—Musir, Raikoke, and Srednoi. The rookeries on these islands are now, however, virtually extinct.

The American herd remains at its home on the Pribilof Islands during the summer, the individuals going out at intervals to feed over a radius of about 200 miles. In November they are driven away by the approach of winter, going southward in the open sea, returning northward near the coast, the range of their movements extend-

ing along the coast of Alaska, British Columbia, and the United States as far south at least as San Francisco. They are not known to come on land anywhere but on the Pribilof Islands except, perhaps, in very rare cases where the animals have been wounded. In like manner the Commander Island herd moves southward in winter along the east coast of Japan, and the herd from Robben Island passes from Okhotsk Sea along the coast of the inland sea of Japan.

THE MALE FUR SEAL.

The male fur seal reaches full maturity at the age of about 7 years. At that time his weight is about 400 to 500 pounds, being considerably heavier when first in from the sea in the spring or fall than in the intervening period when he is fasting on land. The males vary considerably in color, the general shade being black or dark brown, with longer hairs or bristles of yellowish white. These are specially long and numerous on the thickened back of the neck, forming the so-called "wig." The male is commonly known as the "bull," in Russian as "sikatch," in Aleut "atagh." Earlier observers made use of the appropriate name of "beachmaster," which deserves to be retained.

THE FEMALE FUR SEAL.

The female fur seal is much smaller than the male, with soft, smooth fur of varying shades of brown, the younger females being usually, but not always, silvery white underneath the throat. The female bears her first offspring at the age of 3 years, but her full growth is not attained till two or three years later. The average weight of the grown female is about 80 pounds. The female is commonly known as the "cow," in Russian as "matka" or mother. The name "clap-match" used by the early explorers is now obsolete.

THE YOUNG FUR SEAL.

The young fur seal, known as the "pup," in Russian "kotik" or "kitten," is born soon after the arrival of the cow. It is black in color, sometimes brownish on the belly and with a large whitish spot in the axil. Its weight at birth is about 10 pounds.

THE HAREM.

The animals are polygamous, each male capable of holding a place on the breeding grounds having from 1 to 100 females in his charge, the average number being about 30. But the number is subject to variation due not chiefly to the strength of the bull, but dependent upon the preference of the cow for a location and on the relation of the topography of the rookery. The animal makes its home on the rocky shores of the islands in large close-massed bands, forming what are called rookeries. The fur seal is extremely gregarious, individuals seldom venturing far from the main body while on land, though wandering about singly in the sea.

THE YOUNG MALE FUR SEAL.

The young male, known as the "bachelor," in Russian "holostiak," is very similar to the female in color and appearance. The holostiak is not permitted to enter the rookeries in the breeding season. The old males are very strenuous in this regard and the bachelors are forced to form separate herds on what are known as the "hauling grounds." While the males and females on the islands are more or less definitely fixed to the spot selected by them in the breeding rookery, it is not so with the young males, and the movements of the bachelor herds are very irregular. For this reason the hauling grounds are much more extensive than the breeding grounds and their occupancy varies from day to day. From these hauling grounds, in the season when their fur is at its best, the young bachelors of about 3 years of age are driven and killed. These young males are known as "killable" seals. Small 4-year-olds and large 2-year-olds, approximating the size of the 3-year-olds, are also regarded as killable. Mixed with the bachelors are found the so-called half bulls (polosikatch). These animals, from 4 to 6 years of age, have the size and appearance of grown bulls, but lack their strength and courage, and can not maintain themselves on the rookeries.

NAMES OF THE DIFFERENT CATEGORIES OF FUR SEALS.

The eccentricities of the nomenclature of the fur seal has been frequently noted. It seems, for example, incongruous that a "cow" should occupy a place in a "harem" on a "rookery" and bear a "pup," and that the young so born, if a male, should be known for the first years of his life as a bachelor. But these names, as Mr. Elliott has observed, are justified because they are pat. When understood, they create no

confusion. The Russian names, "sikatch" (grown bull), "polosikatch" (half bull or wigged bachelor), "holostiak" (bachelor not wigged), "matka" (mother), and "kotik" (pup), are in common use among the Aleuts on the Pribilof Islands, as well as on the Commander Islands. These words form their plural in i, thus: sikatchi, holostiaki.* The Aleut names, "atagh" (bull), "ennatha" (cow), "lakutha" (th as in the) (pup), are now used mainly by children.

THE FUR SEAL AND THE HAIR SEAL.

The use of the term "seal" in connection with the animals under discussion is somewhat misleading. The original name of "sea bear," given to it by its first discoverer, Steller, is in every way preferable, as the fur seal is not a "seal," nor has it any close affinity with the suborder of Pinnipedia, to which the true or earless seals belong. Beyond the fact that both fur seal and hair seal are carnivorous mammals, feeding on fish and adapted for life in the water, the two types have little in common. In structure, appearance, habits, disposition, method of locomotion, they are entirely distinct and their evolution as pelagic animals has been along separate lines.

THE REMIPEDIA.

The fur seals, with their associates, the walrus and sea lions, constituting the suborder *Remipedia* (Jordan & Lucas), are obviously related to the bears. The hair seals, whatever their origin, must have come along other lines from a different parent stock, and their relation to land carnivora is more remote. The *Remipedia*, among other characters, have plantigrade feet, the anterior limbs modified as oars, and with rudimentary claws, if any. The posterior limbs bend forward at the knee, and the long, webbed toes extend beyond the claws. Only the anterior limbs are used in swimming. The head and neck can be elevated as in the bear, and the external ear is moderately developed. The animal can run or lope along the ground as do ordinary mammals and with considerable rapidity.

THE PINNIPEDIA.

The various forms of true or hair seal, constituting the suborder *Pinnipedia*, have the feet not exactly plantigrade, short, with strong claws, only the posterior limbs being used in swimming, and these not being susceptible of bending forward at the knee. The animal therefore can not walk or lope at all, but only wriggles while on land. Its neck is short and it can scarcely raise its head. There are no external ears.

In the internal structure the differences are equally marked. In both species the thick blubber under the skin goes with the life in cold water. The resemblances associated with aquatic habitat are only analogies and have no value in scientific classification.

Much misconception as to the nature and habits of the fur seal has arisen from its supposed resemblance to the animals called "seals" in the Atlantic; but so long as its fur has commercial value the "sea bear" will doubtless produce "seal skins," and even though killed on land only it will be the object of a "seal fishery."

V. THE PRIBILOF ISLANDS.

The Pribilof group consists of two volcanic islands, both composed entirely of lava and cinders, and known as St. Paul and St. George. Besides these there are two smaller islands, known as Otter and Walrus islands, with the little islet of Sivutch or Sea Lion Rock. These islands are in Bering Sea about 200 miles to the northwest of Unalaska and about 45 miles apart, St. Paul lying to the northwest of St. George.

ST. PAUL ISLAND.

St. Paul, the more important island, is very irregular in form, the greatest length being from northeast to southwest, about 13 miles. Its greatest width is about 10 miles. The volcanic crater of Bogoslof, in the center of the island, rises to a height of about 600 feet. Numerous other volcanic dikes and craters of various heights occur on the island.

ST. GEORGE ISLAND.

St. George is about 11 miles long, east and west, by 7 north and south. It is more elevated than St. Paul, its central peak, Aluckeyak, being 930 feet high. Its shore outline is scarcely broken by bays or indentations, and most of its coast is formed by walls of basaltic rocks.

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*Not "holluschickie."

VEGETATION.

The surface of the elevated parts of both islands are in summer covered with moss and grasses, in which are surprising numbers of showy wild flowers. A list of the species of these has been published by Dr. C. Hart Merriam. Conspicuous among them are the Iceland poppy, the monkshood, with species of lupine, betony, chrysanthemum, senecio, saxifrage, harebell, and many others. The lower parts of the island are covered with a soil of damp black lava sand. Here flourishes a coarse, rank, useless grass—the rye grass (*Elymus mollis*). With the rye grass is the coarse *Putchki*, a species of *Archangelica*, used by the Aleuts as a spice. The abandoned hauling grounds of the fur seal are rapidly invaded by two species of slender light-green grasses known as "seal grass." These contrast sharply with the coarse dark-green rye grass and a luxuriant species of wormwood, neither of which grow on land where seals have regularly hauled. About the rookeries themselves the movements of the seals virtually destroy all vegetation.

CLIMATE.

The Pribilof Islands are almost constantly enveloped in mist. Throughout June and July the weather is continuously cloudy, usually foggy, with almost half the time a dull, drizzling rain, usually accompanied by a southeast wind. Many stormy days occur, but the storms in summer are not violent, although approach to the islands in rough weather is dangerous on account of the dense fogs.

In August there are more clear days, and in bright weather the islands are very picturesque. With the fairer weather the occasional storms become more violent, and by the middle of September all vessels which can get away find it well to leave Bering Sea. With the winter come many clear days, and between them are tempestuous storms. The floe ice gathers about the islands, filling the bights and inlets until April or May, and the snow piles high in the depressions between the hills. The snow banks about Zapadni, on St. Paul, remain till late in summer, serving as landmarks to seamen.

VI. THE FUR SEAL ROOKERIES.

BREEDING GROUNDS.

Wherever there is a rocky beach of some breadth or a sloping rocky hill on the Pribilof Islands, the fur seals have formed their rookeries. The best type of rookery is a moderate slope covered with coarse rocks and descending to a beach of coarse shingle or rounded bowlders. On these rookeries the gregarious habit of the fur seals causes them to crowd as closely as may be, often to their own disadvantage, as on crowded areas many young pups are trampled under foot.

HAULING GROUNDS.

The hauling grounds of the bachelors are usually sandy beaches adjoining the rookeries, ascending on one side to the heights behind the latter. There are also here and there neutral strips in the long rookeries which have been abandoned to the bachelors, and along which they go back and forth to their hauling grounds or parade grounds above the rookeries. Sometimes, as on Tolstoi and Zapadni, the bachelors make runways across the rookeries, which are not recognized as neutral by the adult bulls. Along these strips, which may be said to be not officially recognized as hauling grounds, there is constant disputation between the beachmasters and the moving bachelors.

The different rookeries have for the most part retained their picturesque Russian names. It seems to us very desirable that they should continue to do so. It would perhaps be as well if Russian* equivalents were substituted for the few English names which have come into use.

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* As to the spelling of the Russian names, there has been much disagreement, and the current orthography is often far from correct. In the present report, without attempting extreme purism, we have chosen the spelling which seems most nearly correct. It has been found convenient to name two new sections of breeding territory not heretofore separately recognized. For assistance in this matter we are under special obligations to Mr. Alexis V. Babin, librarian of the University of Indiana, a native of Russia.

The following are the breeding rookeries on St. Paul, beginning with the largest one, on Northeast Point:

1. *Vostochni* (*Eastern*).—This lies as a long strip about a mile in length, mostly on beaches of coarse bowlders, and interrupted at intervals by landing places and hauling grounds of bachelors. Along the foot of Hutchinson Hill the rookery becomes wide and closely massed. Toward its eastern end at Northeast Point it thins out along the rocky beach, the tip of the point, this being the artificial boundary between Vostochni and Morjovi. The view of Vostochni from Hutchinson Hill is the most impressive on the island, a greater number of fur seals being visible there than from any other point in the world.

2. *Morjovi* (*of the walrus*).—This is the continuation of Vostochni, along the southeast side of Northeast Point. It consists of a dense, square mass of seals on rather level ground adjoining the Walrus Bight, a little bay formerly inhabited by the walrus. Along the coarse bowlder-strewn beaches for some distance the narrow ends of the rookery extend, the little spit known as Sea Lion Neck being included in it. Vostochni and Morjovi have usually been considered together as Northeast Point rookery, but our convenience is best met by separate names, as they have separate centers of massing.

3. *Polovina* (*halfway*).—This rookery lies along the sloping hills, cliffs, and projecting reef of Polovina Point, midway between Northeast Point and the village, and on the eastern angle of the island. The main part of Polovina is compact and densely massed. To the northward for half a mile extends a belt of cliffs, with a narrow, rocky beach below. This is occupied by seals, and recorded in our census as Polovina cliffs. Still farther to the north along rocks and columns of basalt is the picturesque, isolated little rookery known as Little Polovina.

4. *Lukanin* (*name of an early explorer and seal hunter*).—At the northern base of the high peninsula at the south end of the island begins the long sweep of Lukanin Bay, with its curved sand beach. To the south of Lukanin Bay, on an irregular, rocky slope of moderate elevation, is Lukanin rookery. It is one of the smaller rookeries, but being near to the village and easy of observation by means of projecting cliffs behind it, it is one of the best known.

5. *Kitovi* (*of the whale*).—This rookery is the southward continuation of Lukanin, along bold rocks, basaltic columns, and slopes of cinders and lava. The division between Kitovi and Lukanin is an arbitrary one at Lukanin Point. For purposes of census observations this rookery is the best situated of all, and on no other large area is the rock formation so favorable for rookery purposes. This is shown by the small number of deaths of pups from the trampling of bulls.

6. *The Reef* (*Riforoye*) is the name applied to the east side of the peninsula which forms the southern extremity of St. Paul. It is a rocky beach with mostly very gentle slope, and interrupted by two ponds filled by the surf in winter and becoming indescribably foul in summer, as the bachelors wallow through them. This is one of the largest rookeries, and it is separated from its fellow (Gorbatch) on the west shore of the peninsula by the broad, flat "parade ground," now overgrown by grass and flowers, but ten years ago worn smooth by the hosts of wandering bachelors.

7. *Sivutch Rock* (*Sea Lion Rock*) is a small, crescent-shaped, boldly rocky island covered with fur seals. On its southern extremity returning bachelors first land in spring.

8. *Ardiguen* (*pile of stones*).—On the southwest edge of the reef, to the west of the ultimate point, is a rocky slope and beach with high parapet-like rocks above it, to which it ascends at one point by a rocky slide. The rocks, slide, and part of the parade ground are filled with fur seal families. The wall-like rocks on the parade ground make it possible to approach very close to these families while unseen by them. It is the best point for observation of family life on the island, and an almost daily record of this life has been kept by us. In view of the isolation of this small body of seals, and of our observations upon them, it has seemed desirable to give the rookery a distinct name. This we have taken from the Aleuts. The percentage of trampled pups was less on Ardiguen than elsewhere on the island.

9. *Gorbatch*.—This picturesque rookery lies along the west shore of the reef peninsula. The shore is generally steep, formed of coarse basaltic columns below and of fine cinders above toward the south end. To the northward coarse rocks and high cliffs appear, which extend to the famous sand beach and hauling grounds known as *Zolotoi* (golden), from its yellowish lava sands. Behind the sand are drifting dunes, and along its eastern margin are Zolotoi bluffs, covered most of the time by waiting half bulls. The nearness of Zolotoi sands and bluffs to the village has brought its bachelor herds under constant inspection.

10. *Spitki*.—A small rookery near the landing place at the village, now abandoned by the seals.

11. *Lagoon.*—A long, narrow reef of coarse bowlders separating the shallow village bay or harbor from the salt lagoon. It is lined with fur seal families, but has no importance as a hauling ground. It is in plain sight and hearing of the village, to which fact its inhabitants show utter indifference.

12. *Tolstoi (thick).*—This rookery extends from the tip of Tolstoi Mys or headland for a long distance on the east side of English Bay. The northern portion of Tolstoi rookery encroaches on the broad sand flat of Middle Hill on the north side of English Bay. The southern portion of Tolstoi lies along the base of considerable cliffs, which at Tolstoi Head become precipitous, leaving no room for harems. Behind Tolstoi rises a steep, rocky slope, up the sides of which the rookery extends. The sand flat of Tolstoi is more densely covered by fur seals than any other part of the island. In the height of the breeding season this crowded area is the scene of constant brawls among the bulls, and the number of trampled pups found here is greater than on any other rookery. On the whole, Tolstoi is the most interesting of the rookeries. The view from above is very picturesque, and there is greater variety in the conditions of life offered by it.

13. *Zapadni (westerly).*—This rookery, the second in size on the islands, extends along the west side of English Bay, from the high and vertical Zapadni headland, as far as the beginning of the sands of Middle Hill. The main part of the rookery is a gentle rocky slope with irregular surface and ragged coast line, the seals in many places closely massed in shallow gullies ("death traps" for pups). To the east, across a narrow sand flat, at the mouth of a little brook, the brow of a rocky hill is occupied by Little Zapadni, an interesting rookery of small size. Then along the coarse bowlders of English Bay is a long strip with isolated patches of fur seals, here recorded as Zapadni Reef. The sandy shores of English Bay, below Middle Hill, often lined with bulls or bachelors, separate Zapadni Reef from Tolstoi sands.

14. *Marunichen (personal name).*—A small rookery on the north shore, long since abandoned.

15. *Bobrovi.*—On Otter Island, 6 miles to the south of St. Paul, the bachelors often haul out. This year a single breeding harem was found there.

ST. GEORGE.

The rookeries on St. George are much smaller than the larger ones of St. Paul and less varied in character, lying mostly along broken cliffs, basaltic columns, and bowlder-strewn slopes. These are the following, beginning with the southwest:

1. *Zapadni.*—On the southwest shore, at Zapadni Bay, on the rocky beach and the ascending rocky benches of a low hill.

2. *Staraya Artil (old camp).*—A very picturesque rookery, ascending the even slope of a long hill, close to the edge of a considerable cliff.

3. *North (Severnoye).*—A large rookery, along the north shore of the island, to the west of the village of St. George.

4. *Little East.*—A very small rookery, just east of St. George village, on a bowlder-strewn slope.

5. *East.*—A larger rookery, scattered along the eastern part of the north shore of the island.

VII. CENSUS OF THE ROOKERIES.

A PHYSICAL IMPOSSIBILITY.

In the general report the details of our attempt at a census of the seal rookeries will be given. It is sufficient to say that a complete and accurate census is a physical impossibility. Any approach to it would have been impossible before the present depleted condition of the rookeries was reached.

THE SOLE ACCURATE BASIS.

The only accurate basis of computation is a count of pups. For many reasons this is very difficult to make, and on the larger rookeries it could only be successful at the risk of smothering and trampling many of them. Any count of pups is possible only during a short period, from about the 10th to the 20th of August. Before the former date the rookeries can not be entered for this purpose on account of the resistance of the bulls. After the latter date the pups have learned to swim well, a large percentage are in the water all the time, and many wander to great distances away from the rookery.

COUNTING OF LIVE PUPS.

The live pups have been counted on Kitovi, Lagoon, Zapadni, Reef, Tolstoi cliffs, Polovina cliffs, Ardiguen, parts of Vostochni and Morjovi, and on Little East rookery of St. George.

COUNT OF COWS.

The cows were counted at the height of the season on these and several other rookeries.

COUNT OF HAREMS AND DEAD PUPS.

The number of bulls in charge of harems, the trampled pups, and the starved pups have been counted on all the rookeries.

Combining all these and other data we have the basis for an approximate census of the number of breeding seals for the present season on the two islands. The census in detail is given below. To the total number of breeding cows, if correct, the number of pups born would exactly correspond.

The first two columns in the table represent the estimate based upon the count of cows and harems made in what is known as the height of the season. The count of live pups afterwards made on certain rookeries and parts of rookeries showed them to exceed the original number of cows counted upon these same rookeries by 75 per cent. The totals, therefore, for the various rookeries in the last column have been corrected to correspond with the actual facts.

The figures here given represent under rather than over estimates, as the numbers missed in actual count are greater than the possible duplications. The same remark applies to the counts of the trampled and the starved pups.

Summary of breeding seals (counts and estimates).

Rookery.	Harems.	Cows (count).	Actual total.
ST. PAUL.			
Kitovi	182	3,152	6,049
Lukanin	147	2,543	4,450
Lagoon	120	1,474	2,484
Tolstoi (main)	389	6,729	11,775
Tolstoi (cliffs)	108	1,498	2,664
Zapadni	583	10,085	17,648
Little Zapadni	210	2,400	4,200
Zapadni Reef	176	2,256	3,862
Gorbatch	302	5,224	9,142
Ardiguen	27	550	652
Reef	504	8,719	15,258
Sivutch Rock	63	1,090	1,907
Polovina (main)	138	2,387	4,177
Polovina (cliffs)	86	1,268	2,496
Polovina (little)	45	779	1,363
Vostochni	975	15,879	27,148
Morjovi	293	4,328	7,773
Total	4,348	70,361	123,048
ST. GEORGE.			
North	225	3,891	6,809
Little East	44	761	1,350
East	135	2,335	4,086
Zapadni	182	3,148	5,509
Staraya Artil	75	1,297	2,269
Total	661	11,432	20,023
Grand total	5,009	81,793	143,071

Bobrovi (Otter Island) had 1 harem, containing 5 cows and 5 pups.

TOTAL NUMBER OF FUR SEALS.

To obtain the total number of seals on the islands during the present summer we should add to the 143,071 breeding cows an equal number of pups born, 5,009 active and 2,996 reserve bulls, making a total of 294,141. These animals are, of course, not all alive at the end of the season. The numbers have been reduced by the loss of trampled and starved pups and by the loss of mothers killed at sea.

Thus far the census has some claim to accuracy; but there are no trustworthy data obtainable for the number of yearlings, male or female; none for the virgin 2-year-olds, and none for the spared or rejected bachelors, 2-year-olds, 3-year-olds, and half bulls. We have no data for estimating the losses suffered by the pups in their first winter at sea. We know little of the enemies they encounter. The

great Killer (*Orca orca*) is the only animal certainly known to devour pups at sea. For about ten days in the later part of September and the early part of October schools of these ferocious animals (miscalled "whales") numbering 3 to 7 daily were seen patrolling the shore waters of St. Paul and St. George. That they were feeding largely upon the swimming pups and seals was plainly shown by the flock of gulls which constantly hovered over or lighted in their wake. The mangled carcasses of one pup and one cow were washed ashore, but no estimate can be made of the number actually killed by them.

Of the destruction from other enemies we know less. It is not, however, likely that any considerable number are destroyed by sharks, and but one species of shark capable of injuring them is known from the North Pacific. This is the mackerel shark, or porbeagle, called salmon shark at Kadiak (*Lamna cornubica*). We can only guess as to whether one-half, two-thirds, or three-fourths of the pups survive the first winter. The number of 3-year-olds is probably a little more than one-third of the pups born three years ago. No count of yearlings, male or female, will ever be possible. The sole factor, however, essential to a consideration of the maintenance of the herd is the number of breeding females, and the figures regarding these are fairly accurate. For those who insist upon an estimate of totals for all classes of seals the following figures are submitted for the two islands:

SEALS OF ALL CLASSES AT ONE TIME OR ANOTHER ON THE ISLANDS OF ST. PAUL AND ST. GEORGE, SEASON OF 1896.

Breeding females		143,071
Pups born		143,071
Active bulls		5,009
Reserve bulls		2,996
Half bulls		5,000
Four-year-old males		10,000
Three-year-old males	15,000 to	20,000
Three-year-old females	15,000 to	20,000
Two-year-old males	20,000 to	30,000
Two-year-old females	20,000 to	30,000
Yearling males	25,000 to	35,000
Yearling females	25,000 to	35,000
Total	429,147 to	479,147

SEALS KNOWN TO HAVE DIED ABOUT THE ISLANDS OF ST. PAUL AND ST. GEORGE FROM VARIOUS CAUSES, SEASON OF 1896.

Cows found dead on rookeries	131
Bulls	28
Bachelors	3
Pups, from trampling, drowning, straying, etc	11,045
Pups, from starvation	16,019
Bachelors (quota)	30,000
Pelagic catch	29,398
Total	86,624

Total living during season	429,147 to	479,147
Total dead during season	86,624 to	86,624
Total alive October 15, 1896	342,523 to	392,523

HISTORY OF THE PRIBILOF HERD.

The size of the Pribilof Islands herd, according to the statement of the Aleuts, reached its lowest point some fifty or more years ago at the time of a great ice jam, in which many thousands of seals were drowned while attempting to climb the inaccessible bergs and floes. Of the condition of the herd in Russian times we have not a clear record. When the herd passed from Russian to American control in 1868 it was in good condition and was rapidly increasing. In the interregnum many bachelors were slaughtered by raiders, but the females were spared, as heretofore. Until 1872 and perhaps a few years after the herd continued to increase. During the period from 1872 to 1878 it doubtless remained practically in a state of equilibrium under the various checks acting upon it, of which the trampling of pups was the chief, the Northwest catch, which remained stationary at about 5,000 during these years, being another element of check. In 1878 the Northwest catch increased to 8,000, in 1881 to 10,000, the following year to 15,000, and in 1883 to 16,000. About

this year the sealers entered Bering Sea. It is probable that with the doubling of the Northwest catch in 1881, which, in addition to the loss of mothers it involved, would produce an increased secondary loss in 1883 by the failure of a certain number of the pups of 1881 to return as breeders, the decline of the herd began. In 1886 the Northwest catch fell from 21,000 to 13,600, but the Bering Sea catch rose suddenly to 14,000.

DECLINE OF THE HERD.

From this time on the decline was more rapid and has been continuous, though there is evidence that the modus vivendi of 1892–93, by which Bering Sea was closed to the sealing fleet, has produced for 1895 and 1896 a slight check of the diminution. The reason for this is that in addition to the saving of mothers, no pups were starved to death in 1892 or 1893, and those which might have been starved have returned as breeders or as killable seals in 1895 and 1896. The cessation of land killing which took place at the same time has produced only harm to the herd by the needless augmentation of the number of 6 and 7 year old bulls which now struggle in vain to enter the rookeries at the height of the season. There has never been a time since 1870 at least when the cessation of land killing could have been helpful to the herd on the Pribilofs.

KILLABLE SEALS ONLY NOTICED BY MOST OBSERVERS.

The facts and dates above given can only be approximately stated. In past times the interest of all persons concerned has centered in the number of killable seals, while the condition and numbers of the breeding females have received little attention. Almost every account of the diminution of numbers is based on the fewness of bachelors or on the deserted condition of the grass grown hauling grounds. Decrease in numbers of killable seals is not a cause in itself. It does not appear till the cause has passed. For example, the killable seals in 1896 are largely the pups of 1893, and their number depends on the conditions surrounding the females of that year. If these pups were killed as 2-year-olds in 1895, the hauling grounds would be empty in 1896, even though there were no decrease of females. The number of killable seals was probably fewer in 1890 than at any period before or since. This is due in part to the losses from pelagic sealing, but primarily to the fact that the natural bachelor quota of that year had been taken in 1889 or even in 1888. But this fact in itself did not indicate diminution of the breeding herd—only the premature gathering of its marketable increment.

We have explicit records of the number of bachelors killed year by year, and of the dates at which it was possible each year to fill the quota. But of the numbers of females and pups we have until 1895 no exact records whatever.

DISTRIBUTION OF SEALS ON ROOKERIES.

In general, the greater the number of females the more extended are the bounds of the rookeries in the height of the season. This general rule can not be used for exact computation of numbers, because the rookeries often grow sparse as the seals diminish in numbers without material change in dimensions. Moreover, in all cases, at least at the present time,* the seals are very unevenly distributed, their arrangement being as unequal as that of trees in a forest. On some rookeries, as on Tolstoi sands at the height of the season, the seals lie thick as swarms of bees, almost all the surface being covered and each adult seal being restricted to about 12 square feet (11,775 cows estimated on about 140,000 square feet of surface). On other rookeries, as the Lagoon, detached harems sprawl over the rocks and each seal has upward of 35 † square feet. Between these every intermediate condition may be found, and the attempt to establish an average acreage of breeding seals is the continuous multiplication of estimates by assumptions. In some cases errors may be made to balance errors. Where errors do not balance each other comes the curious result that the most accurate estimate is that farthest from the truth.

ELLIOTT'S CENSUS OF FUR SEALS.

The first serious attempt to estimate the number of seals on the Pribilof Islands is that of Mr. Henry W. Elliott in 1874. Mr. Elliott recognized first the important fact that "the mother seals are coming and going," while the pups, remaining near

* According to Mr. Elliott, they were everywhere as close together as they could lie in 1874.

† Sixty-five square feet, according to Messrs. True and Townsend, but their count was made when about half the females were absent.

their birthplace, furnish the only "sure guide to the whole number of seals on the rookeries."

Assuming the supposed law that the rookeries are always equally crowded everywhere in the height of the season, and estimating 2 square feet on the average for each seal, old and young, he finds on the two islands 6,386,840 feet of rookery space, representing a total of 3,193,420 breeding seals and pups, or about a million breeding females.

This estimate, while containing many elements of error, and, in our judgment, nearly 70 per cent too high, is still not so far out of the way as it appears at first sight. It is certainly true that a cow occupies ordinarily more than 3 square feet and a pup more than 1. On the other hand, Mr. Elliott is right in saying that in a few days or a week after the birth of the pup "the cow takes to the water to wash and feed, and is not back on this allotted space one-half the time again during the season." Some other cow returning occupies the 3 feet allotted to her. Even in the height of the season the population of the rookeries is constantly changing, the earlier cows being away before the new ones come, and the real size of a harem being nearly double the largest number of cows counted. Besides this, the return of the virgin females and belated females in late July greatly extends the rookery space itself beyond the outlines taken in these measurements. In 1890 Mr. Elliott found 1,818,786 square feet of breeding space on the two islands. This was supposed to represent a total of 959,393 breeding seals and pups. It would appear that the rookeries were less exactly measured than in 1874, as an allowance by estimate was made on each one on account of the thinning out of the seals. In any event, in spite of the fact that there were at least half more seals in 1890 than in 1895, the estimates of acreage made by Messrs. Townsend and True give for 1895 2,616,063 square feet. This would give about 7½ square feet each for 160,000 seals with their pups and 30,000 virgin two-year-olds.

We can not believe that even in the most favorable times the fur seals were evenly crowded over the rookeries, and it is evident that as they grow fewer their arrangement tends to become more sparse, especially on rocky slopes and bowlder-strewn beaches.

Acreage estimates can only serve us in default of better, but it is fair to early observers to remember that no other method of enumeration was possible on a large scale until very lately.

DIFFICULTIES IN MEASURING ACREAGE.

It is by no means an easy task to find the acreage of any rookery. The length of its sea front is easily ascertained, but its average width is at the best a matter of conjecture. It will spread out over level ground, shrink away from soft sand, climb up the hill in gullies, extend high over cliffs, break at a cove to permit bachelors to land, thin out among large rocks, then widen in great amphitheaters. Its lower boundary fluctuates with the tides. Its extent behind grows day by day with the arrival of late-coming seals, and its whole outline is changed in a few days, as the bands of virgin 2-year-olds come into the ranks late in July. A comparison of the different estimates of the number of square feet on the individual rookeries which have been already published will show how large these elements of uncertainty are. A few feet added to the width of any rookery means the addition of thousands of seals to the estimate.

ESTIMATES OF TRUE AND TOWNSEND.

The most recent computation of the acreage of seals is that made by Messrs. True and Townsend in 1895. Here the number of square feet is measured from the current maps, on which the outline of the rookeries has been sketched by the aid of the eye. But the details of the maps were not exactly surveyed and the outlines of the rookeries could not be.

VARIATIONS IN ROOKERY OUTLINES.

An element of uncertainty which enters into all estimates based upon observation and comparison without exact enumeration is the fact that there is no line of demarcation to show the outer limit of any rookery. The ground for a considerable distance back of the line of harems presents exactly the same appearance as the space occupied by the seals. If there occurs a change of a few feet or yards in the extent of the rookery, it is impossible for the eye to detect it. Nor can the vacant space back of the rookeries be relied upon to indicate a decrease of territory occupied by the seals. As a matter of fact, after the period of confusion consequent upon the arrival of the virgin cows, the departure of the old harem masters, and the ingress of the half bulls, the rookeries gradually assume another fixed phase. The cows

and pups draw back to the higher grounds, oftentimes leaving entirely bare the space originally occupied. The general form of the new arrangement corresponds roughly to that of the old, and remains constant during September and October. Reef rookery, which was particularly observed in this regard, showed on September 8 the cows and pups drawn back so that the line of Townsend's crosses,* none of which had been reached in the breeding season, formed the center line of the mass. Though all the cows and pups of this rookery were driven off at least three times in the last week of September, they resumed their old position so exactly, that the eye could detect no difference in the arrangement. This position, practically unchanged, they occupied on the date of the last observation, October 22. It would doubtless only be broken up with the final departure of the cows and pups in November. This backward movement effectually obscures any line of demarcation that might be formed in the breeding season, and there is nothing to guide the eye in determining the difference in location, if any, between the rookeries of one year and of the next. For this reason, faithful as the work of the observer and map maker may be, it can not be made exact.

HALF THE COWS ONLY PRESENT AT ANY ONE TIME.

Furthermore, it is now known that definite and relatively constant as are the boundaries of the rookeries at the height of the season, the number of cows then found is not the number of breeding seals. At no time in the year are more than about one-half the breeding seals present on the rookeries at once. This is shown by the fact that the number of pups on any rookery is nearly double the greatest number of females counted on it at any one time. The yearlings and virgin two-year-olds do not come to the islands until after the rookeries have passed their period of greatest compactness, and none were present at the time of the counts made in 1895.

COUNT OF PUPS.

Until this year it had been regarded as impossible to test these counts and estimates by an actual count of the pups. The finding of 6,049 pups on Kitovi rookery, while the maximum number of cows in the height of the season was but 3,152, shows that the number of cows arriving late is much greater than had been supposed. Examination of other rookeries shows the necessity of adding 75 per cent to the count of females to include these absentees.

ESTIMATES FOR 1895.

The investigators for 1895 have estimated the number of breeding cows on the rookeries at any one time in the height of the season as 70,423 for the two islands. This estimate is not far from correct and is probably slightly below the truth. There are two reasons for thinking that it is an underestimate. First, the count was made a little early, when "the rookeries may not have quite reached their breeding height." At Lagoon rookery, for example, all the harems counted were visible from the boat in Village Cove. Later in the season we found some twenty or more harems on the inner side of the ridge of rocks and out of sight from the waters of the Cove. These were doubtless overlooked in 1895. Second, the estimate that the massed rookeries, as Tolstoi, Vostochni, are but twice as densely populated as Lukanin and Kitovi, is probably incorrect. A count of dead bodies on Polovina killing grounds shows an average of 13½ square feet to each body. On Ardiguen rookery an isolated harem of 33 cows was noted, and its boundaries marked from a distance by stones which circumscribed it. When the seals were absent at the time of the count of starved pups, in September, this space was carefully measured, and showed an average of 8 square feet for each seal. Where seals are massed on rookeries, the space occupied by each seal is more nearly 12 than 23 square feet. The estimate, therefore, of 23 square feet is too high, and consequently the number of seals based upon it is too low for the massed portions of the rookeries, even if 16 square feet, which, as a matter of fact, is doubtless also too low, be taken for the other estimate.

Accepting the figures of last year, 70,423 cows on the rookeries would mean an aggregate of 123,240 breeding cows. To this number must be added 25,000 to 40,000 virgin two-year-olds and as many yearlings to form an estimate of the actual number of cows for 1895. That the figures given by us for 1896 are slightly higher than those for 1895 does not mean an increase in numbers since 1895, but simply an increase in the data on which an estimate may be made. Messrs. True and Townsend, for example, count 2,640 cows on Kitovi rookery. This count is the most important

* The white crosses were painted in 1895 on rocks marking the backward extension of the large masses of seals on the various rookeries at about the middle of July.

element in their estimate by acreage. In this estimate, Kitovi is given credit for 3¾ per cent of the total number of seals (70,423). This figure can not be far from the truth. But the fact that, in 1896, in spite of some shrinkage, Kitovi shows 6,049 pups, demonstrates that the figures based on counts made at the height of the season are far from complete. 6,049 is 3¾ per cent of 161,060.

ACREAGE ESTIMATES AND PHOTOGRAPHS UNSATISFACTORY.

For reasons above indicated, we have been unable to accept estimates of acreage of rookeries or the testimony of maps as indicating with exactness the amount of decrease. Series of photographs taken from year to year show clearly the fact of decrease, but give no exact data as to its amount. The photographs examined by us go back only to 1892. Those taken later in the year than July 20 are of little value for comparison, for after that date the outlines of the rookeries change from day to day. Moreover, there is no assurance that photographs taken the same date on successive years show the same or relative conditions, as the arrival of the seals and doubtless their movements on the rookeries are affected by the state of the weather and the advancement of the season.

TOWNSEND'S CROSSES.

The most definite evidence of decline since 1895 lies in this fact that in that year Mr. Townsend painted a white cross on a rock at the head of each of the large masses of breeding seals as located at the height of the season. In no case was any of these white crosses reached at the corresponding period in 1896. This shows the fact of the diminution, but not the amount.

DECREASE OF HAREMS.

Another item of importance is this: In 1895 Mr. Murray made a careful count of the number of harems of the two islands, finding 5,000 in all. At the same period in 1896 he found that the number of harems was reduced to 4,853, a loss of 3½ per cent, the number of bulls without harems having increased 7 per cent. As the same influence which lowered the number of harems would tend to make them also individually smaller, this might mean a decrease of 3½ times 3½ per cent, or nearly 10 per cent since 1895. But as to this there can be no certainty. An estimate of the decrease in the number of pups born in 1896 as compared with 1895 may lie between 3 and 10 per cent, but can not be made more exact by any data in our possession.

ELEMENTS OF CHANGE IN THE HERD.

The changes in the breeding herd from year to year lie in the following elements:

1. The addition of the 3-year-old females who bear their first pups.
2. The loss of females killed at sea in the previous fall, those killed in the spring, those killed by the bulls, and those destroyed by natural causes. Keeping these elements in mind, we may attempt a comparison between the breeding herds of 1895 and those of 1896.

In 1896, 30,000 killable males were taken, 22,000 of these, to the best of our information, being 3-year-olds. Some 2,000 or 3,000 more of these are left, while nearly as many more were killed in 1895 as "long" 2-year-olds. Of male pups born in 1893, therefore, about 26,000 survived till they became killable. As many 3-year-old females entered the rookeries to bear their first pups in 1896. These numbers represent something less than a third of the pups born in 1893.

A tabulation of the gains and losses from 1895 to 1896 would then run as follows:

Gains: 3-year-old females bearing their first pup (about)	26,000
Losses:	
a Females killed at sea, August, 1895 (about)	23,000
b Females killed at sea, April, 1896 (about)	8,000
c Females shot at sea and lost, unrecorded (about)	5,000
d Females killed by bulls, 1896	130
e Females lost at sea by natural causes, unrecorded (about)	10,000
Total	46,130
Estimated net loss for 1896, 12½ per cent of total breeding cows	20,130

The uncertainty of each of these elements, and especially of *c* and *e*, leaves the calculation almost valueless.

ESTIMATES FROM QUOTA OF BACHELORS.

Perhaps the best basis for an estimate of the total decline of the rookeries since 1880 is found in the simple fact that in 1883 it was as easy to get 100,000 acceptable skins of the sizes now taken as it was this year to get 25,000, or 30,000 at the most. This would indicate that the number of breeding females was at least four times as great in 1880 as in 1893. This is probably not very far from the truth, although but little dependence can be placed on it. The last killings were then usually over by the 20th of July.* The last killing for 1896 to complete the quota of 30,000 was made on July 27.

PROPHECY.

Prophecy as to the future is even more uncertain than estimates of the past. If a count of pups should be made on Kitovi rookery about August 15, 1897, the variation in numbers from 6,049 will serve as a fair index to the change in the number of breeding cows. It is most important that an accurate count should be made of this rookery each year in the future. The percentage of change on both islands will not vary far from that found on Kitovi. The reopening of Bering Sea to pelagic sealing in 1894 ought in 1897 to show itself in a reduction of the number of 3-year-old breeding cows and in the number of killable males on all the rookeries. This loss diffused over the whole islands will not, however, be very conspicuous on any one rookery. Great as the waste through pelagic sealing has been, it is to be remembered that the islands still contain a vast body of seals. To the eye 5,000 seals scattered among the rocks seem almost as many as 10,000. There is still a strong nucleus of the Pribilof herd left, and this will take care of itself when no longer wasted by the slaughter of gravid and nursing cows. Protection at sea would in a comparatively few years restore the herd to its highest condition. Nor need it find in the numbers of 1880 its highest limit of expansion. The rookeries can be improved and extended by artificial means. The trampling of pups by bulls could be greatly checked, or even almost eliminated, by piling rocks in the death traps. On Zapadni Rookery, of St. Paul, a beginning was made this fall by filling in with loose stones the beds of the two gullies which furnished such a large proportion of the dead pups of this rookery. Instructions have been given to have the sand flat of Tolstoi covered with rocks. This is by far the worst of the death traps. Tolstoi is white with bones of trampled pups, accumulated for centuries. There is no evident reason, no females being killed, why the hauling grounds should not furnish even 200,000 killable males each year.

ESTIMATES OF PAST CONDITIONS.

If there are on the Pribilof Islands 143,071 breeding females, or a total number of about 440,000 of seals of all grades, there may have been in 1895, 155,000 breeding seals, or a total of 475,000. In 1890 possibly 280,000 breeding females, or a total of 600,000, the percentage of young males being in that year unusually low, and in 1880, 600,000 breeding females, 1,500,000 of all grades collectively.

In our judgment these estimates have very little value, but no better ones are possible. It is certain, however, that the seal herd was never "ten times" nor seven times its present size.

VIII. BREEDING HABITS OF THE FUR SEAL.

ALL COME TO THE ISLANDS.

So far as known, every individual fur seal visits the islands in the course of the summer. The youngest come latest, and in general all categories remain until driven away by the winter storms in November.

THE BULL.

The male fur seal is capable of procreation, in some cases at least, at the age of three years. He is not, however, permitted by his seniors to take charge of a harem in the height of the season until he is about seven years old. The adult males arrive on the islands as soon as the ice leaves in the spring (in April or early May). They

*The log book of the island gives the following dates for the completion of the quota: 1871, July 28; 1872, July 25; 1873, July 24; 1874, July 17; 1875, July 22; 1876, August 2; 1877, July 14; 1878, July 18; 1879, July 16; 1880, July 17; 1881, July 20; 1882, July 20; 1883, July 19; 1884, July 21; 1885, July 27; 1886, July 26; 1887, July 24; 1888, July 27; 1889, July 31; 1895, July 27; 1896, July 27.

take up their positions and await the arrival of the females, which event is accompanied by constant fighting among the males. The earliest cows appear the first week in June. They come on land but a short time before the delivery of their pups. After delivery the females are held in the harems by the bulls until after impregnation, when they go to sea to feed, returning at intervals to nurse their young.

THE COWS.

The cows do not come in all at once. The period of their arrival, and consequently of the birth of pups, extends from early in June until the middle of August, with probably scattering births as late as the first week in September. The female first comes in heat at the age of two years. The virgin* two-year-olds come to the islands late, few, if any, before the last week in July. They are not found on the rookeries at the height of the season. In the last week of July and the first week of August they are gathered with late-coming adult cows in harems outside of the rookery proper; most of them behind it. These harems are usually in charge of young bulls, and have not the stability of the adult harems, as most of the young cows do not remain after impregnation and their places are taken by others.

GESTATION.

The period of gestation is about three hundred and fifty-five days, or a little less than a year. For virgin females it is without doubt somewhat shorter, as none of these are impregnated before the 25th of July. The uterus has two horns or branches, one to the right, the other to the left, and the single pup is born in one of these horns. Soon after parturition, apparently within a week, the ovary of the opposite side matures an ovule, the cow comes in heat, and is covered by the bull. The second pup is thus developed in the other horn of the uterus. While the first horn is recovering from gestation and parturition the second is made ready for gestation. For the rest of the life of the animal a pup is borne each year on alternating sides.

The development of the fœtus is at first very slow, as it remains minute during the whole period of lactation. Nothing is known of its growth in the winter. At the time of birth in June or July the pup is large and far advanced in development as compared with the young of most mammals. Its weight at birth is from 9 to 12 pounds, and it is very soon able to find its way about the rookeries. We can only conjecture as to the age attained by fur seals—possibly 10 to 15 years for females and 15 to 20 for males, but this is a guess only. There is no reason to believe that either males or females outlive the power of procreation. The oldest female recorded, judging age by the wear of the teeth, was in milk when speared. There is no doubt that all female fur seals breed annually, and no reason to think that any cow in heat escapes impregnation. Mr. Lucas finds on examination of the ovaries of many cows killed at sea that in each case examined impregnation has taken place on first coming in heat. To this there are probably very few exceptions. These would appear the next year as late-born pups of adult mothers.

SCARS ON THE OVARY.

Whether a cow is impregnated or not, can be determined by the scar in the ovary. As to this we quote the following from notes of Mr. Lucas:

"As it may naturally be asked, What reason is there for supposing the scar on the ovary to be the scar of impregnation and not merely the rupture of a Graafian follicle? it may be answered that—

"Of the 190 ovaries examined by Mr. Townsend, Mr. Barrett-Hamilton, and myself, in only one case did an ovary bear more than a single scar, and in this case the second scar was faint.

"In specimens obtained early in September the ovarian scar and the corresponding branch of the uterus had increased in size, showing clearly that impregnation had taken place, and it is not assuming too much to say that in the fur seal ovulation is practically synonymous with impregnation. That this should be so is not surprising when the facts in the case are considered.

"In the first place, a female after entering into a harem is held there until the bull is satisfied he may properly allow her to leave, while back of the harem and in the water in front are idle bulls watching for stray females.

"Finally, when the harem system is relaxed there is an influx of young bulls, who before this time could not enter the rookeries, and if every female were not impregnated they would be likely to discover the fact."

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*The categories of fur seals here called virgin two-year-olds and virgin yearlings were shown to be such by the killing and dissection of individuals, the two-year-olds from the small harems behind the Reef rookery, the yearlings from the bachelor herd of Lukanin; still others were lassoed for examination and released.

DR. SLUNIN'S THEORIES.

Mr. Lucas further notes: "From the examination of a large series (200) of ovaries it can safely be said that there is nothing whatever to corroborate Dr. Slunin's statement that it is possible to determine from the appearance of the ovaries how many young a cow has borne. The surface of the ovary does not bear scars corresponding in number to that of the pups, for not more than two scars, and this very exceptionally (3 cases in 200), are present on an ovary at one time. The scar of impregnation, corpus luteum, develops very slowly and slowly disappears, a cross section of the ovary revealing its presence long after all traces have disappeared from the surface. Dr. Slunin, it is stated, examined the ovaries in alcohol, and he probably mistook the slight depressions caused by the shrinkage of the Graafian follicles for scars. A section of the non functional ovary shows it to be a fine-grained, homogeneous mass with no developing follicle, while the ovary which is for the season functional may have as many as eight Graafian follicles in various stages of development. There has not yet been time to carefully examine the ovaries bearing two scars, but it may safely be set down as a general rule that the first ovum to reach maturity is fecundated, so that to repeat the statement made above, ovulation and impregnation are practically synonymous."

COPULATION.

There is no reason to think that the serving of cows in the ordinary harem causes any serious drain on the vitality of the bull. A bull has been observed by Mr. True to copulate twice within half an hour. The season during which his services may be required extends over a period of fully sixty days.

In copulation the male assumes the position usual in dogs and related animals. The female lies prone upon the ground and bears his clumsy weight. It is not likely that copulation takes place elsewhere than on the islands, and never at sea except occasionally on rocks awash off the shore. Here young bulls sometimes secure young females in heat, and impregnate them without leaving the water. It is possible that copulation begun on a rock might continue even after the rising water floated the animals off. A case of this kind is recorded by Mr. True, but none was seen by us. As the virgins do not appear on the rookeries before the last of July, there is not much doubt that the first period of gestation is somewhat shorter than the others, those coming in heat early in August bearing pups early in July. Such a difference is found in horses. I am indebted to Mr. Frank W. Covey, of Palo Alto, for statistics showing that with ten virgin mares the period of gestation varies from 328 to 344 days, the average being 336.8; with ten adult mares, the range is 332 to 360, the average 347.8.

The first pup noticed on St. Paul the present season was seen on Reef Rookery June 14. It was then apparently several days old. The last birth witnessed was on Zapadni Rookery August 14. No record of early instances of copulation was made. The first case witnessed by us was on North Rookery of St. George July 9. The last instance of copulation seen was on Tolstoi Rookery, St. Paul, August 27.

BELATED IMPREGNATION.

It is evident, also, from the actions of the old bulls, a certain percentage of whom return in September to their places on the breeding grounds after feeding, that should any cow fail to be served in June, July, or August she would find service even in September. That such belated service sometimes occurs is borne out by the fact that several hundred small black pups were noted in October on the rookeries of St. Paul. One of these, killed on October 18, was found in good condition and with stomach full of milk. It weighed 14½ pounds. An unborn fœtus, taken from a cow on Zapadni Reef August 14, weighed 11 pounds, and the experimental pup, taken from Zapadni rookery on August 1, supposed to be about a month old, weighed 12 pounds. A gray pup, killed at the same time as the small black one, weighed 29 pounds, and two weeks before a similar pup had been killed on the same rookery which weighed 33⅜ pounds. The little pup could not have been much over a month old, and therefore must have been born in September.

HEIGHT OF THE SEASON.

The height of the season, or the period when the most pups are born and sex activity is greatest, is from July 6 to July 15. At this time the harems are held in rigid control by the bulls, who are constantly "rounding up" their cows and crowding them close together. At this time, however, only about half the adult cows and none of the 2-year-olds have arrived. When these have come, most of the earlier cows have gone away to feed. At no time, therefore, are much more than half the cows present on any given rookery, and the count of any individual harem can be only an approximation.

ONE AT A BIRTH.

There is no authentic record of the birth of twins. It is not likely that it ever occurs.

EQUALITY OF SEXES IN NUMBER.

The sexes are approximately equal in number. Of 658 pups examined as to sex 335 were found to be males. For the first year males and females are alike in form, size, and color. With the end of the first year the growth of the males is much more rapid, and the weight of the bull (300 to 400 pounds) is probably nearly five times that of the cow (80 pounds).

IX. ALLEGED CHANGES OF HABITS.

NO POSSIBILITY OF DRIVING SEALS ELSEWHERE.

No notable changes in the habits of the fur seal have resulted from any action of man. It is not possible for man to "drive away" the fur seals from any of their haunts except by killing them all. There is no foundation for the idea that if the fur seals are disturbed on one island or rookery they will go to some other. Their harem or rookery is their home, and to it they will return so long as they live, and the ordinary disturbances of man have only the slightest temporary effect on them.

PRECAUTIONS AGAINST DISTURBANCE.

The precautions against wanton invasion of the rookeries by the natives or by casual visitors are well enough in themselves, but have been carried to absurd lengths, as in the prohibition of smoking or the use of nailed shoes on the rocks, and the like, in force now on the Commander Islands. For such intrusions or disturbances a herd of seals care no more than a flock of sheep would do.

FOOLISH FEARS.

The scientific observers of previous years have often been hindered in accomplishing their mission by foolish fears* of overzealous officers that their studies might cause the seals to take fright, and perhaps to leave the islands altogether

If proper observations of the rookeries themselves had been permitted in earlier years, the great and useless loss of pups trampled in the "death-traps" of Tolstoi, Zapadni, and other rookeries might have been discovered and checked.

In the log books of the islands we find such entries as these:

"*August 28, 1879.*— * * * Complaint has been urged (by the natives) against the disturbance of the rookeries in getting specimens for Dr. White. * * *

"*June 11, 1891.*—It is a plain fact that the hauling grounds are yielding four times as many seals as were taken last year on the same dates. * * * We think that the constant and persistent running over the rookeries of Elliott last year at this time may be charged with a large part of the falling off of seals driven. * * *

"*November 11, 1895.*—Examination of Reef, Lukanin, Polovina, and Tolstoi rookeries demonstrates the fact that the seals there are mixed bachelors, pups, and cows together, well hauled back from the water—a condition which, I am told, has never existed before to such an extent. The seals seem restless. * * * Whether this is due to the constant disturbance during the summer or breeding season (1895)—they being constantly subject to daily scientific and photographic investigation—can not be positively said, but I am of that opinion." * * *

All these notions are without foundation in fact. In general they originate in suggestions of the Aleuts, whose ideas in matters of this kind are untrustworthy. These people have had no experience of any kind with domestic animals. We learn from the log book that at one period the Reef, Kitovi, and Lukanin were culled over annually to get the winter supply of pup meat. The driving up of all the cows, bulls, and pups on a rookery, and the sorting out of the male pups from the females (often done three times in succession on the same rookery within a week), to get the quota of 5,000 pups, was calculated to work more mischief than the properly conducted observations of a whole year. And yet no complaint was made, and apparently no evil effect was experienced from these disturbances. To the Aleuts these matters, with which they have been familiar all their lives, seem normal. The restlessness of the seals noted in 1895 was frequently observed by us, and found to be dependent upon the state of the weather. The mixed condition of the seals also noted was not peculiar to the year in question, but occurs every year with the end of August; and many entries in logs show that in previous years drives had to be postponed for the same reason.

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* In justice to the present Treasury agents it should be said that in 1896 no effort was made to impede the work of investigation in any way on account of fear of its effect on the seal herd.

INTERFERENCES FROM EXAMINATION.

In the work of the present summer an excellent opportunity was afforded for observing the effect of interferences upon the herd. The rookeries were under constant inspection from early in July till late in October, and necessarily frequently visited. At the time of the counts of the dead pups of early August and late September it was necessary to drive the entire body of seals off to the hills or into the water. In August there was some tendency to stampede, and it was often an hour or more before the members of a herd would return and settle themselves again in their places. In September, however, they were reluctant to go from the rookeries, whatever the effort to move them. It was found in most cases even difficult to drive them away at all. When driven away they resumed their places at once; in some cases in the interval between driving off and the counting of the pups, necessitating their removal a second time.

The bachelors are considered more timid than the other seals, and more likely to be affected by disturbance. They are, it is true, more easily frightened off, but this is probably because they have no particular interest to hold them to one place as have the bulls and cows. They are constantly driven during the season from hauling ground to killing ground, being culled over and sent back to the sea only to return and haul out on their favorite grounds a few hours or a few days later. This process has been going on year after year for upward of half a century, abundantly showing that the treatment of the bachelors on the islands does not drive them away or change their habits. As for the breeding females and bulls, they are not disturbed when on the islands except for purposes of investigation, and no evil effects come from this cause. As soon as a scared fur seal comes to rest he becomes wholly indifferent as to matters of the past. When an idle bull was shot for scientific purposes, an event which occurred several times, his fellows would come about when the body was being skinned, sitting down on the sands at 3 or 4 rods distance, showing a sleepy interest, but not the slightest trace of sympathy or fear.

THE MORE VISITED THE BETTER, EXCEPT IN JULY.

In general the more frequently the seals are visited, except in the height of the breeding season, the better for the herd, as they become used to the presence of man. On the rookeries most visited by us—Ardiguen, Lukanin, Kitovi—the animals paid least attention to our presence and showed least alarm or disturbance. In the height of the season any intrusion of man produces some confusion. This is mainly because the efforts of the bulls to quiet their harems furnish a pretext for the invasion of the rookeries by the waiting or idle bulls. In these struggles the pups may be injured. But the stampedes or the quarrels of the seals are matters of slight importance, except as affecting the new-born pups. Nothing will stampede an adult bull in the height of the season. He is absolutely fearless, and he will not let his cows run away.

The following note, under date of August 1, is quoted from the daily journal of observations:

"The bull is much quicker to detect the nature of the intruder than the cow, which fears man chiefly when he is moving. A bachelor seal can often be surprised when asleep, and the surprise is sometimes mutual, as a big fellow starts up unexpectedly from behind a rock and dashes away in great haste. If it is an old bull that is surprised, he will plunge at you; but before he has gone 10 feet he will turn about to see what his cows are doing. Then you can get away, for after he has once looked back he goes no farther. He will turn from an intruder to intercept the flight of his cows. This he does by snorting, growling, blowing out his musky breath, by seizing the cow and bending her neck backward to the ground, or by seizing her by the back and tossing her over his head. The cows are afraid to leave when the bull exhorts in this way, and during the period when the harems are well defined the cows are more afraid of the bull than of any intruder. But after July 20, when the cows have become impregnated, their fear of the bull passes away, and the older ones do as they please, running away when frightened. Later on the young cows also become more independent. When a cow wants to go and the bull interposes, she bites him in the neck. For the most part he takes it patiently enough, though sometimes the fur comes away with the cow's sharp teeth."

EFFECTS OF ODORS.

It has been suggested that the smell of the decaying carcasses of the seals on the killing grounds is offensive to the seals and is likely to drive them away. In reference to the odor itself, the following note, also taken from the journal of August 1, is pertinent:

"As to the indifference of the seals to the smell of decaying flesh, it is to be remembered that flesh does not decay rapidly in the far north. A dead seal will remain

fairly fresh for a week, and the odor of the killing ground, with thousands of decaying carcasses upon it, is not usually noticeable to human beings a fourth of a mile away. Even at close range the smell is not putrid, but rather a tanyard-like smell of blubber and oil growing rancid. Under no circumstances is the strong putrid odor of southern latitudes to be detected. The rookeries have a strong musky smell of excrement and urine, much like the breath of the angry bulls, but, while strong, it is not very offensive."

That the odor of the killing ground has produced no effect on the cows and bulls is clearly shown by the uninterrupted occupancy of Lagoon Rookery during all the time when the village killing ground, then the only killing ground on the island, was situated just across the narrow channel forming the entrance to the lagoon, in plain sight and only a few hundred feet away. To-day one of the favorite hauling grounds of the bulls in August and September, and a place frequented during the entire season by bachelors, is on Zolotoi sands, within a few hundred feet of the present village killing ground. In the main the killing grounds are well away from the hauling grounds and rookeries, but there is no evidence to show that were they close it would have any effect on the actions of the seals. Late in the fall the odor from the earlier dead pups becomes very offensive. This may annoy the cows and pups lying on or near them, and this may have something to do with the backward movement of these animals in September and October, but this is by no means certain, and the seals withdraw not merely from the places where the dead bodies are thickest, but from other places as well. In fact, there is nothing whatever to show that the seals themselves notice or pay any attention to such odors or to any odors proceeding from objects at a distance from them. The great care often taken to approach a herd of fur seals from the leeward side is usually unnecessary.

REDUCTION IN NUMBER OF BULLS.

Some slight alterations in the conditions of life necessarily result from the interference of man. Reduction of the number of bulls causes them to take their stands farther apart. This in some measure reduces their turbulence. Killing at sea has still more rapidly reduced the number of females, thereby causing a general thinning out of the harems. This enables the individual bull to "round up" more easily those cows he claims as his own, and with less interference from jealous rivals.

NATURAL SELECTION.

There is no evidence that the race of fur seals as a whole has been in any way affected by the arbitrary selection of males for killing. Only strong, vigorous males can maintain themselves on the rookeries in any case, and those allowed to live are not more or less vigorous than the others would have been. The variations in these regards are not great, and effects, if any exist, would not appear for many generations, perhaps not for centuries. Careful supervision might make an effective artificial selection possible, and such experiments, whether leading to practical results or not, are worth trying. But it is certain that the character of the herd has not been affected by any act of man. It is to be remembered that a strong selective influence is exercised by the migrations in the sea. Only the vigorous members of the herd survive the experiences of the winter. No decrepit individuals have been known to come back in the spring. The rough sea of the North tells no tales, and we know very little of the severity of the sorting process which every year sends back to the islands only those fit to survive.

With the fur seal, natural selection has to do mainly with the struggle against conditions of life. The competitive struggle of individual against individual is a very slight element. The success of the individual male depends rather on his location than on his strength or prowess. The choice of place by females determines in the main the size of the harem. From the ruthless natural destruction of all seals in which the geographical instinct or the instincts of feeding and reproduction are defective, results the extreme perfection of these few instincts which the animal possesses.

INSTINCT AND INTELLIGENCE.

The life processes of the fur seal are as perfect as clockwork; but its grade of intelligence is low. Its range of choice in action is very slight. It is a wonderful automaton, and the stress of migrations will always keep it so.

By intellect or intelligence in this sense is meant the power to choose among different possible courses of action. The external influences and internal impulses produce certain impressions on the nervous system of the animal. By the automatic instinct the response which follows is directly related to the cause, and there is no choice among responses. So much influence; so much rebound. By the operations of instinct each individual in given conditions will act just as any other individual will. Intellect, however, implies individuality. One animal will choose to do this,

another that, adapting action to the special needs or circumstances. A fur seal will do what his ancestors have had to do to perfection. If he is led to do anything else he is dazed and stupid. For these reasons our experiments in better methods of culling killable seals by sending the herd through a wooden chute were not successful. The most experienced bulls would beat their noses against a door closed before them, if another seal had been seen to pass through it. That one door was shut and another opened is beyond their comprehension.

X. PELAGIC SEALING AND ITS EFFECTS.

KILLING AT SEA.

By pelagic sealing is meant the killing of fur seals in the open sea with firearms or with the spear and club. After feeding, the animals lie and sleep on the surface of the water during the digestion of their food. Taking advantage of this habit, the hunter steals up in his boat and shoots or spears the sleeping animal

On shore the life of the female fur seal is sacred; she is like a domestic animal of high value. On the sea she is a wild beast, to be killed on sight.

INDISCRIMINATE KILLING.

Pelagic sealing is, in its essence, indiscriminate killing, or killing without reference to sex, age, or condition. Its effects on the fur seal herd are precisely the effects which indiscriminate killing would produce on any other herd of polygamous animals, as cattle, sheep, or horses. Other things being equal, the maintenance or increase of a herd depends on the birth rate; that is, on the number of breeding females.

NUMBER OF COWS.

On the Pribilof Islands the number of female fur seals (cows), exclusive of the young of the year (pups), is about double the number of males (bulls, half bulls, and bachelors). The smaller number of the males is due to land killing, the quota of skins taken by the lessees of the islands being made up wholly of young males. As the services of 1 male are adequate to from 25 to 100 females, and perhaps a much greater number, land killing, unless inordinate, can not check the increase of the herd. As the females are at present about twice as numerous as the males, killing at sea means killing at least two females to one male. The evil effect of such killing is immediate, continuous, and cumulative.

NORTH PACIFIC CATCH.

In the pelagic sealing of the North Pacific, January to May (May and June being now closed months), the fur seals are killed while on their migrations. The snow and ice of winter drives most or all of them from the island, while their need of food leads them to the southward. Their southward limit varies greatly. The females and young males often reach the latitude of San Francisco * and perhaps farther. The pups of the year are not known to go beyond Cape Flattery, while the old males remain about the Fairweather grounds in the Gulf of Alaska. In the North Pacific the number of females killed is about proportionate to the total number of females, or about two to one as compared with the males. These adult females are in all cases heavy with pup. Barren females are virtually unknown. Only one such case, a cow, with deformed (abortive) ovaries is on record.† The death of a cow in the North Pacific involves one less birth for the year in question, as well as for the succeeding years of her natural life.

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* These matters are still much in need of investigation. According to Dr. Merriam, the fur seals formerly taken about the Santa Barbara Islands probably belonged to an undescribed species (now almost extinct) resident on Guadalupe Island.

† The following account of this animal is taken from our field notes:

"On August 1 a barren cow was found in a pod of bachelors on the parade ground of Reef Rookery. From an examination of the teeth and skull she was found to be an adult cow, probably about 5 years of age. She was above medium length, but slender and of rather less than medium weight. The throat was very dark brown in color; rusty below as well as above. She was killed for purposes of study. On examination the mammæ were found to be fairly large and to have undergone pathological fatty degeneration. The glandular structure was obliterated. The ovaries were found to be small, about one-fourth the size of those of the virgin 2-year-old cows recently examined. The fallopian tubes and uterus were similarly atrophied. The right ovary contained a small Graafian follicle and egg. The germinal spot was visible in the egg and not impregnated. There was evident no sign of impregnation or of capacity for impregnation. No signs of corpus luteum or scars of previous impregnation were visible. The opening of bladder was so small as to require a probe to find it. There was no trace of hyperæmia, the tissues being pale and bloodless." (Dissection by Dr. Otto Voss and D. S. Jordan.)

BERING SEA CATCH.

In Bering Sea pelagic sealing, June to September (June and July being now closed months), means in general the killing of fur seals while temporarily absent from the islands for the purpose of feeding.

ALL COWS PREGNANT.

As a rule all females, except yearlings, taken in Bering Sea after the first of August, the present end of the "close season," are pregnant. In the very short interval between parturition and impregnation the bulls never allow the cows to leave the "harems." A certain number of the adult cows (7 per cent in 1896) lose their pups early, the young being trampled on in the quarrels or clumsy movements of the bulls. The remaining adult females (93 per cent of the whole number) have each a pup, which is left on shore while the mother goes out to feed. This pup is wholly dependent on its mother's milk for nourishment until its departure with her in November from the islands. The death of the mother therefore involves the death of the pup and of the unborn fetus. Yearling females are sexually immature. Most of them do not arrive before August 10, when the breeding season is virtually over, and their movements are as irregular as those of the young males. The 2-year-old virgin females come to the islands late in July for impregnation and remain there for the rest of the season, except for occasional food excursions.

FEEDING HABITS.

The adult males never leave their stands on the rookeries during the breeding season. Toward the middle of August they go out to feed, returning at intervals to their place on the rookeries or to sleep on the sands for the remainder of their stay on the islands. The young females and bachelors probably come and go for food at regular intervals during the summer, but as feeding with them is not such an urgent necessity as with the cows they are doubtless less frequently found on the feeding grounds and being more timid are not so often taken by the hunters. The pelagic catch in Bering Sea is therefore necessarily very largely made up of adult females.

PROPORTION OF FEMALES KILLED.

According to data collected in 1895 by Mr. A. B. Alexander, while on board the sealing schooner *Dora Sieverd*, out of 1,577 seals comprising the season's catch of that vessel 62 per cent were females. For the most part the sex statistics regarding the pelagic catch are confused and untrustworthy, but from additional figures collected in 1895 by Mr. C. H. Townsend, the accuracy of which we have no reason to doubt, covering a wider range of conditions, the actual per cent of females is found to rise somewhat above 70. This percentage is not a permanent one, but will change from year to year. A deficiency in land killing raises the percentage of males, and vice versa. The proportion of adult females is in general highest toward the middle of August, the older males going to sea in greater numbers, while more young males would be taken in July. The number of pups (16,019) known to have starved to death on the Pribilof Islands in 1896 through the death of the mothers is about 55 per cent of the number of skins (29,398) recorded as brought to ports by vessels engaged in pelagic sealing in Bering Sea.

PELAGIC SEALING A SUICIDAL INDUSTRY.

Pelagic sealing in Bering Sea in August is therefore in the highest degree destructive to the herd. If considered as an industry, it is a suicidal one, as it can be profitably continued only under conditions which must bring it to a speedy end. Pelagic sealing is therefore not properly an industry at all, as it adds nothing to the wealth of the world. Since it began more than 600,000 fur seals have been taken in the North Pacific and in Bering Sea. This means the death of not less than 400,000 breeding females, the starvation of 300,000 pups, and the destruction of 400,000 pups still unborn. In this calculation account is taken only of those of which the skins have been brought to market. No record of the animals lost after being shot or speared is available, though the number is known to be very great.

PELAGIC SEALING SOLE CAUSE OF DECLINE OF HERD.

Pelagic sealing, in the judgment of the members of the present commission, has been the sole cause of the continued decline of the fur seal herds. It is at present the sole obstacle to their restoration and the sole limit to their indefinite increase. It is therefore evident that no settlement of the fur seal question as regards either the

American or the Russian islands can be permanent unless it shall provide for the cessation of the indiscriminate killing of fur seals, both on the feeding grounds and on their migrations. There can be no "open season" for the killing of females if the herd is to be kept intact.

PREGNANCY OF FEMALES AT SEA.

As stated above, all females taken at sea on the migrations, except yearlings and 2-year-olds, are pregnant. Those taken at sea while on feeding excursions are, if 3 years or more of age, both nursing and pregnant. From this number must be excepted about 7 per cent whose pups have been crushed to death and who are pregnant, but no longer nursing. All 2-year-old females are pregnant, but not in milk.

THE VIRGIN YEARLINGS.

The yearling females have undeveloped ovaries. They do not appear on the islands till the first week in August. They then roam freely over rookeries and hauling grounds as privileged characters. Many of them play with the pups, much as little girls play with dolls. In the fall, after the pups have taken on their gray coat, it is not easy to distinguish the yearling females from them. The yearling males are larger. Among the pups no such marked difference is noted, the females being but slightly smaller than the males.

In numbers the nursing females are about equal to all other classes of seals taken together (pups excepted).

XI. LOCATION OF FEEDING GROUNDS.

It is known that female seals feed at great and various distances from the islands, and that they go in various directions to the southeast, south, southwest, and westward for this purpose. There is no way of determining accurately the period of absence or the distance traveled by any individual, because the individuals can rarely be marked or continuously observed. The length of absence ranges from a few days to a week or more, probably being longer as the pup grows older. The nursing females are known to go as far as 200 miles from the islands.

NO SEALS IN THE NORTHEAST QUADRANT.

According to Capt. Horatio D. Smith, of the revenue cutter *Perry*, very few seals feed in the cold waters to the north and northeast of the Pribilof Islands. On a cruise of 900 miles in early September, 1896, neither seal nor sealing vessel was sighted in this region. Here the ocean floor is comparatively level, and the temperature of the water about 37°. In the southwest quadrant the usual temperature is about 46°. The success of the pelagic sealer depends on his knowledge of where to look for seals, and the maps prepared from sealing records furnish most of our information in this regard. A series of such maps will accompany the final report.

MIGRATIONS.

Mr. Lucas gives the following summary of our present knowledge of these matters:

"From data collected by Mr. C. H. Townsend, it appears that in Bering Sea the seals are found between longitude 165° to 175° in a broad tract stretching northwesterly from the vicinity of Unimak Pass to latitude 63°. A few are found outside these limits, but the main body of the herd is found in the locality given between June and November, because this is their great feeding ground. During spring and winter the seals occur in a belt skirting the coast of North America for a distance of 100 to 500 miles from shore from the vicinity of the Farallones around to Unimak Pass. Scattering seals have been reported at as great distances from land as latitude 40°, longitude 148°, and from latitude 48°, longitude 165°, northeastwardly to the Shumagin Islands. The old bulls in winter frequent the Gulf of Alaska, while the females and young males range farther south. All these seals found at sea are practically feeding seals, the lines of migration being determined by the food supply, and all female seals above 2 years old are breeding seals, either recently impregnated and with young on shore as well, or with the fœtus in a more or less advanced condition. It has been suggested that the route of migratory seals is influenced by the temperature of the water, but there are no data to adequately substantiate this, while there is every reason to believe that food is the main factor in the case. The homing instinct is also to be considered in this connection."

XII. FOOD OF THE FUR SEAL.

SURFACE FISHES AND SQUID.

The food of the fur seal consists mainly of surface-swimming fishes and of squid. As to the species of fish, the fur seal has probably little choice. It does not dive deeply and its food is naturally made of the shallow water or surface fishes on its feeding grounds.

IN BERING SEA.

In Bering Sea, in August and September, the Alaskan pollock (*Pollachius chalcogrammus*) seems to form by far the most important part of the seal's diet. In the stomachs examined by Mr. Lucas this species far outnumbered all others, the squid coming next in frequency. Salmon are eaten when found, and occasionally species of smaller fishes not yet fully identified.

Mr. Lucas observes:

"Squid and young pollock are eaten in large quantities, the beaks of 155 squids having been found in one stomach and the bones of 41 young pollock in another. It must, however, be borne in mind that this does not mean that all these were eaten at one time, for a study of the stomach shows that food is eaten and the hard parts regurgitated continually but irregularly."

From data obtained by Dr. C. Hart Merriam it appears that a large portion of the food of the seals found in the North Pacific between latitude 56°, longitude 59°, during April consists of a species of red rockfish (*Sebastodes*) and an almost equally large portion of squids (*Gonatus amœnus*); some pollock (*Pollachius chalcogrammus*) and smaller fishes are also eaten.

No codfish or halibut has been found by us in seals' stomachs. These bottom fishes probably swim at depths too great for them to be often taken by the fur seal. No species of shark or dogfish ever has been found in the seal's stomach so far as known to Mr. Lucas, to Dr. Merriam, or to myself.

SPEWINGS ON THE ROOKERIES.

About the Commander Islands the spewings of the fur seals consist largely of the beaks of squid. On the rookeries of the Pribilof Islands spewings containing squid beaks and eyes, also the flesh and bones of pollock, were found. This is almost the only evidence we have on land of the feeding of the seals. It is likely that the animals do not come on land with food in their stomachs except in very rare instances. The only evidence we have of these exceptional cases is in the presence of the spewings.

FEEDING OF BACHELORS.

During the killing season the stomachs of the bachelors are found to be empty. It has been supposed on this account that they fasted during the summer. This is probably not the case. At a food killing on October 15, on St. Paul, 59 seals were killed. They were driven from Zolotoi sands, to which they had returned the day before after an absence of three weeks. They gave every indication of having fed largely, but the stomachs of the entire lot were empty. During September and October four cows were killed for investigation of the development of the fœtus. The animals were chosen with reference to throwing light also on the food question. Their stomachs were wholly devoid of food. A large adult bull recently in from feeding and so fat that he could scarcely walk was killed in October and found without food in his stomach.

SEALS REMAIN IN WATER WHILE FOOD DIGESTS.

From these facts it seems clear that the fur seals remain in the water until the food in their stomachs is digested. Investigation of the supposed feeding of pups shows that they are doubtless also in the water for the same purpose. This explains the presence of the mass of seals which were constantly seen through the entire season swimming about in an aimless fashion before the rookeries. It also explains why cows are never seen to come directly in from the sea, but always apparently from the fringe of idle seals offshore. They delay to finish digesting their food. It also obviates the necessity for supposing that the bachelors fast during the summer. In the case of the adult bulls the fasting is necessary, but no good reason can be assigned for the alleged fasting of the bachelors. Their continuous plumpness indicates that they do not fast.

MR. ALEXANDER'S OBSERVATIONS.

Concerning the food found in the stomachs of seals on the feeding grounds of Bering Sea, Mr. A. B. Alexander observes:

"The material which has been found in the stomachs of seals taken in different parts of Bering Sea indicates that only a small percentage is composed of fish which inhabit deep water. It is only reasonable to suppose, however, that when seals are in shallow water they feed on both bottom fish and on those near the surface. A not uncommon component of their food is the red rockfish, which occurs in both deep and shallow water, and possibly also near the surface at times, which would account for its being found in the stomachs of seals captured where the water is 100 fathoms or more deep.

"Surface fishes, and especially squid, seem to be the natural food of the seal. In the stomachs that have been examined a variety of material was found, such as pieces of Alaskan pollock, salmon, and other fishes, but it has also been observed that in localities where squid are plentiful very little other food may be looked for. I am informed by hunters that on the coast of Japan and off the Commander Islands squid occur in great abundance, and that it is not an uncommon sight to see a half dozen or more seals together feeding on the tentacles of an octopus floating on the surface. Sealers find squid plentiful off the island of Kadiak, and in that locality they have often been found in large quantities in the stomachs of seals."

Outside of Bering Sea the food changes somewhat. The pollock grows rare to the southward, while salmon, herring, and rockfish become abundant. Doubtless these and other available fishes are eaten in numbers. We have no reason to suppose that the seal prefers the flesh of any one species to another.

AMOUNT OF FOOD CONSUMED.

Calculations as to the amount of food consumed by the fur seals have little value. Nor is it likely that lack of food is an important element in checking their increase.

It may be noted in this connection that the pollock, which makes the chief food of the fur seal, has never been sought as a food fish. In Bering Sea more valuable fishes, as the cod, halibut, and Atka-fish, are very abundant, rendering the utilization by man of the pollock unnecessary. In no case is it likely that the great cod and salmon fisheries of Alaska will be affected in any way for good or ill by the fur seal. Its destruction of salmon amounts to but little. It neither eats sharks nor is it eaten by them. The dogfish is not recorded from Bering Sea.

XIII. FOOD OF THE PUPS.

SEALS NURSE THEIR OWN PUPS ONLY.

The nursing fur seal never knowingly feeds any pup other than her own. She knows her own pup as surely as the mare knows her own foal. As the pup grows older he learns to know his mother's voice unerringly. While the mother shows little affection for her pup and generally treats it with indifference after she has recognized it and given it an opportunity to nurse, there is no difficulty in determining when mother and pup meet and recognize each other. And if this matter were in doubt, no one would be able to mistake the savage way in which the female fur seal treats a pup which is not her own. The starving pups were closely observed with a view of determining whether any of them succeeded in nursing other cows. Occasionally a pup would be seen to try to nurse some sleeping cow, but the cow always awoke instantly and savagely repulsed the starveling. Such a pup dare not approach a cow that was awake. There can be no doubt whatever that if a pup loses its mother before it is weaned in November it can not find another cow to give it nourishment and must starve.

The following is a typical record of attempts of starving pups to secure milk:

"Reef, September 1: I see a little starving pup below me. He is moving about calling out and nosing about the breasts of sleeping cows. He has tried three and been driven off with a growl and snap from the waking cow. He wanders some distance. Comes up to a sleeping cow whose pup is either nursing or asleep with his nose at the nipple. The starveling takes hold and evidently nurses for some seconds. But the cow, as before, wakes and snaps at him with unwonted vigor. Her own pup has been asleep. Evidently she had been misled by the fact of his having recently been sucking. The starveling gives up and lies down." (G. A. C.)

WEANING OF PUPS NOT BEFORE NOVEMBER.

A number of pups were killed in the fall of 1896 to determine if possible whether they feed on anything but milk. In no case before October 22 was any food other than milk found. The following extracts are taken from Mr. Clark's field record:

STOMACHS EXAMINED (PUPS).

"*August 29.*—Pup killed on Lukanin; stomach contained only milk.

"*September 11.*—Male pup accidentally smothered on Kitovi; stomach empty.

"*September 22.*—Two male pups taken on rocks at the warehouse; both stomachs contained milk only.

"*September 26.*—Two large well-nourished pups, one male and one female, found freshly dead from drowning on Lukanin beach; stomach of female, empty; male full of milk only.

"*September 28.*—Pup with deformed nose killed at Zapadni; stomach contained milk only.

"*September 30.*—Large black pup accidentally killed by falling over a cliff; stomach contained milk only.

"*October 1.*—Large gray female pup killed on Gorbatch; stomach contained milk and two small crustaceans.

"*October 5.*—Starving gray pup in dying condition on the Reef killed; stomach contained a few crustaceans and several shreds of seaweed.

"*October 6.*—Two pups killed on Tolstoi; milk only found in their stomachs.

"*October 11.*—Two large gray male pups killed on Gorbatch; stomachs empty.

"*October 13.*—Two pups, male and female, killed on Lukanin; stomach of male empty; of female contained milk only.

"Two large gray pups killed on Kitovi; stomach of one full of milk; of the other empty, except for one small tunicate.

"*October 14.*—Three pups killed on Kitovi. (1) A starving pup, stomach containing one soft-shelled crab; (2) a very small pup, stomach full of milk; (3) a large gray pup, stomach empty.

"*October 20.*—Gray pup shot in water off Zolotoi playing with seaweed; stomach full of milk; excrement like that seen on beach in rectum and intestines.

"All stomachs examined contained pebbles."

XIV. LAND KILLING OF BACHELOR FUR SEALS.

LAND KILLING USEFUL TO HERD.

Land killing has been for many years limited to the removal of a definite number of young males, chiefly 3-year-olds, with occasional "long 2-year-olds" and "short 4-year-olds." Owing to the polygamous habits of the fur seal a very small percentage of males suffices for the needs of propagation. An excess of males is positively and extremely injurious to the herd, because of their excessive fighting and the consequent destruction of pups and cows. Hence this removal of male life tends distinctly to favor the increase of the herd.

OVERKILLING AS AFFECTING THE HERD.

As it has been claimed that killing of males has been a cause of the decrease of the herd, it is necessary to treat this matter in some detail. The term "overkilling" in this connection is susceptible of two meanings, both of which should be clearly understood.

While a small percentage of males is sufficient for reproduction, a certain number is absolutely essential. If reduced too low or cut off entirely the effect must be disastrous. Such a condition, however, could not be easily brought about and might be not even possible. For example, if the young male life of 4 years and under on the Pribilof Islands were to-day entirely wiped out, the herd would not be injured by such loss within about five years, for the supply of males of 5 years and upward on the island would not be exhausted within that time. Breeding would go on as usual on the rookeries and the usual increase would take place. Although it would not be possible under these conditions to secure killable seals on the island, still the life and increase of the herd would be in no way affected. Furthermore, such action to be dangerous must be kept up year after year.

LITTLE DANGER OF OVERKILLING.

Overkilling of males in such a way as to injure the herd has never occurred on the Pribilof Islands, certainly not in American times. Under present conditions it could hardly be brought about. A certain number of vigorous and otherwise uninjured males are every year rejected on the killing grounds and allowed to escape to the sea because of some defect in the skin, as a scar from a bite. In addition to this there are on St. Paul two rookeries of considerable size (Sivutch Rock and Lagoon), besides several minor hauling grounds, from which bachelors are never driven, and which in themselves are probably capable of supplying from year to year the necessary augment of bulls.

It has, however, been suggested that such overkilling has occurred, and as an attempt has been made to connect it with the beginning of the decline of the herd by supposing that at some time there were not enough bulls to serve the cows, and that the usual number of pups was not born, it may therefore be worth while to consider the facts in the case.

The decline of the fur seal herd began to be noticeable from 1886 to 1890, markedly so in the last-named year. If due in any sense to a scarcity of bulls, such scarcity must have occurred three years previous, as a falling off in the birth of pups could only be noticed at the time when they would naturally return as 3-year-olds to the breeding and killing grounds. There is nothing in the history of these years to warrant the supposition that there was a scarcity of bulls. There is in fact no evidence whatever that any normal adult female on the island ever failed of impregnation.

But we are not forced to rely on negative evidence. There is positive proof that such a scarcity of bulls as to cause failure in impregnation could not have existed. In 1876 and 1877, instead of the full quota of 100,000 skins, for commercial reasons, only 89,000 and 75,000, respectively, were taken, the market being overstocked. In 1875 and 1878 the full quota of 100,000 skins was taken. There is no reason for supposing that the full quota could not have been taken in the intervening years. As a result of this reduction in the killings for 1876 and 1877, 35,000 young bulls must have been saved on the Pribilof Islands, and these in 1885-86 must have been 10 years of age and still in their prime when the decline of the herd was well under way.

OVERKILLING AS AFFECTING THE FUTURE QUOTA.

Overkilling in the sense of premature killing has occurred beyond a doubt. This affects the quota of future years, but does not injure the herd itself. There is every reason to believe that in 1887 to 1889 the fixed quota of 100,000 skins had become too great for the depleted herd, the pups of three years before having been largely starved to death under the action of pelagic sealing. For this reason the supply of 3-year-old seals fell short and the deficiency was made up by drawing on the 2-year-olds. This in turn increased the difficulty in getting the quota for the succeeding year, and the cut went deeper until it reached even the larger yearlings. The effect of this action shows itself clearly in the drop from 100,000 skins in 1889 to 21,000 in 1890. In the preceding year almost all 2-year-olds and many of the yearlings had been taken. This sudden drop does not represent a correspondingly sudden reduction in the size of the herd. It might occur even if the herd were increasing. As a matter of fact, at the time, the herd had been slowly but steadily declining under pelagic sealing. The fixed quota of 100,000 had been kept up by lowering the size of skins. Instead of reducing the quota as the herd declined, the original number was maintained until the killing came to an abrupt stop. But it can not be too strongly emphasized that the breeding herd need not be affected if the wandering bachelors on the hauling grounds had been wholly extirpated.

Had such close killing as this been continued indefinitely it would possibly have been disastrous in time, although this is far from certain. It was, however, followed in 1892-93 by an almost complete cessation of killing of males pending the modus vivendi. The result of this action is shown in the present overstocked condition of the islands as to bulls, a condition doubtless more injurious to the herd than a moderate deficiency in male life would be.

No doubt the difficulty of getting the quota in the later eighties was slightly intensified by the wasteful practice then permitted of killing each fall 3,000 to 5,000 male pups for food. If, as there is some reason to suppose, in the early years of this practice absolute care was not taken to select only males, then the killing of pups may have had an insignificant share in addition to pelagic sealing in reducing the herd. But such effect, if ever felt, could have been only temporary, as after the first year or two there is no doubt that the killing was restricted to male pups only.

OVERKILLING OF MALES NOT A CAUSE OF DECLINE OF HERD.

Overkilling of males, therefore, does not enter as a factor in the diminution of the seal herd. Overkilling as affecting the quota occurred only in the later eighties, and the conditions were at the time of a special nature. Such killing would not naturally

be practiced by lessees of the islands, as it is suicidal in its effect and would injure the business of taking seal skins on land long before it could in any way affect the life of the herd. In all these regards the interest of the lessees of the islands must be identical with those of the herd itself, and therefore with those of the Government of the United States. That the percentage of bulls really necessary for the needs of the herd is a small one is well illustrated by the experiments on the Commander Islands.

CONDITIONS ON BERING ISLAND.

On Bering Island for some years past no "killable" bachelors have been spared, and the proportionate number of bulls is now very far below what it has been under the closest killing on St. Paul. On Poludennoye (South) rookery, Bering Island, for example, there were in 1895 five bulls, in 1896 three bulls, to between 500 and 1,000 females. Yet this number, assisted perhaps by immature males, has been shown to be entirely adequate for the impregnation of all females. According to Mr. Barrett-Hamilton, of the British Fur Seal Commission, to all appearance every cow on this rookery had a pup in 1896. The same observation has been confirmed by Mr. Emil Kluge, and by Dr. Stejneger and Captain Moser, who visited the rookery at about the same time. In his report on the Russian Fur Seal Islands (p. 64) in 1895, Dr. Stejneger observes:

"On that rookery (Poludennoye) the disproportion between the two sexes was excessive in 1895. According to reliable information, the number of bulls on the whole rookery did not exceed five. Judging from what I saw of this rookery during two visits, I should place the number of breeding females at about 600, possibly only 500. It would be a comparatively easy matter to observe this year (1896) whether the number of pups born be very markedly small in proportion to the number of females hauling out."

On the larger Severnoye (North) rookery of Bering Island the conditions are much the same, although the numbers neither of bulls nor of cows can be counted. The number of bulls is, however, so small that the bachelors wander at will over the rookeries. In the drives made from time to time, bulls, cows, pups, and bachelors are brought up together. In the harsher régime of the Russian islands, the extreme killing of bulls as well as other experiments apparently hazardous have been tried, in this case without apparent harm so long as the breeding rookeries are undisturbed.

On Medni Island, all bachelors that can be secured are killed each year. There are, however, two or three hauling grounds (Sikatchinskaya, etc.) which are virtually inaccessible, and in these are reared what is considered a superfluity of bulls. Although on none of the rookeries of the Pribilof Islands are bulls as few as on Medni, yet on the latter island 172 superfluous bulls were this year killed for leather.

The proportion of adult bulls to impregnated cows on the Pribilof Islands is now about 1 to 22 (idle bulls and virgin 2-year-olds being included). The average number of adult cows in the harems in July is 30.

WRANGLING BULLS.

The evil effects of the overstock of males have never hitherto been fully understood or estimated. The chief cause of death on the rookeries among females and young pups is found in the wrangling of the bulls and in the struggles of the reserve or idle bulls to steal cows from the harems. More than 10,000 pups were trampled to death on the Pribilof Islands in 1896, and about 130 cows were killed by the rough seizure of the bulls in their struggles for possession.

As the fur seal herd has year by year grown less crowded, this mortality has probably never reached so low a percentage before. In the original or wild state of the herd, when the number of adult bulls was nearly equal to that of the cows, this destruction must have been enormous, perhaps approaching 200,000 each year. It was undoubtedly the chief check on the indefinite increase of the herd. The death of these thousands must have been adequate to compensate for the natural increase. The removal of superfluous bulls may also have the effect of relatively increasing the food supply.

WAITING BULLS.

Around each rookery, behind, before, and on each side, and on the rocks awash on the sea front, there are now, throughout the month of July, several outpost lines of idle bulls, active and pugnacious, which prevent any invasion of the harems by the bachelors, although constantly attempting such invasion themselves. This condition continues until the drives of bachelors are finished, the last week of July, and prevents any possibility of female fur seals being drawn into the drives, or of the driven bachelors escaping to work confusion in the rookeries. Later in the season most of these reserve bulls succeed in forming harems from virgin 2-year-olds and belated adult females.

INSTITUTION OF HAULING GROUNDS.

The bachelor fur seals have a wholesome and well-grounded fear of these bulls, keeping away from them and from the rookeries. This leads to the institution of the separate hauling grounds on which the bachelors wander, play, or sleep at will. The sea in front of the rookeries is also a play space for them. Only fear of the bulls keeps them away from the harems. When the old bulls leave the rookeries in August to feed the bachelors scatter themselves over the breeding grounds. The oldest of them, the half bulls (5 and 6 years old), usually enter first, endeavoring to play the part of the older bulls, which they do with great apparent satisfaction. On the return of the latter in September, these are again driven off.

On Bering Island, as already stated, the number of adult bulls is very small. There are now no separate hauling grounds. The bachelors lie about the harems even in June and July, and when they are sought for killing, the whole herd, males, females, and pups must be driven off together. For this reason the drives on Bering Island are not made at the time of the height of the breeding season.

Such a condition has never existed on the Pribilof Islands. During the killing season the bachelors are perforce obliged to stay away from the rookeries, and the harems are not disturbed when the young males are driven to the killing grounds.

Beyond the mixing up of the herd, which is inconvenient to the fur seal killers and dangerous to the pups, no evil effect of the reduction of males has been reported from Bering Island. So long as the bachelors herd separately in July and are not found diffused through the rookeries, it may be safely assumed that there are adult bulls enough. Fortunately, also, as has been shown, any error in this respect will make itself felt first in the quota, and is capable of immediate rectification. Furthermore, the Government has it in its power to fully regulate this matter.

Since 1890 the quota of males to be killed has never been a fixed one, and the Government agents take care that a sufficient number of young males are each year allowed to escape to replenish the stock. At present about 5,000 adult bulls are in service in the harems. This number is evidently far more than enough. Doubtless ten years is a low estimate of the period of service of a bull. The saving of 500 to 1,000 young males each year would probably be fully sufficient to keep the stock replenished.

XV. NEED OF SCIENTIFIC SUPERVISION OF THE BREEDING HERDS.

The continuous investigation of these matters should be undertaken. The herd should be treated as a breeding herd of cattle or horses would be. It should be under the immediate control each summer of a competent naturalist, who should devote his energies to the study of the needs of the herd, its preservation, increase, and possible improvement.

IMPROVEMENT AND EXTENSION OF THE ROOKERIES.

In this connection, I may call attention to the great need of improvements in the rookeries themselves. For a slight cost the death traps described in detail below could be repaired and obliterated, and the lives of thousands of pups each year could be saved. The rookery grounds themselves could be extended both on St. Paul and St. George by blasting off the cliffs and strewing the flats with bowlders. The whole front of Tolstoi and Zapadni headlands, for example, by the use of dynamite, could be made available for breeding grounds, and similar extensions could be made on North and East rookeries of St. George.

Such extension, of course, could not be necessary except in case of the complete protection of the herds at sea; but with the spread of common decency in international affairs this condition should be brought about. It is vastly more important that the fur seal herd should be saved and enlarged than that any individual nation should have the profits of their slaughter.

There is no sacredness to be attached to the natural state or conditions of a wild animal. Animals, like men in a state of nature, are pushed to the utmost by hard conditions. There is probably no wild animal whose conditions of life could not be artificially improved by human interference if it were thought worth the while.

XVI. METHODS OF KILLING OF BACHELOR SEALS.

In the drives on the Pribilof Islands the bachelor seals only are included. These are brought in droves from the hauling grounds to the killing grounds located at convenient distances from the rookeries, preferably near a pond of water. The drives are usually made in the night, the seals arriving at the killing grounds early

in the morning. This is to prevent, so far as may be, overheating. After the seals have rested for a time the killing is begun. The larger droves are separated into small "pods" of 20 to 30, which in succession are driven up within reach of men armed with stout clubs. These "cull" out the "killable" seals (3-year-olds, large 2-year-olds and small 4-year-olds) by striking them on the head, allowing the non-killable seals (yearlings, small 2-year-olds, and all "wigged" seals) to escape and go back to the sea. The blow of the club renders the animal instantly unconscious, if it does not kill it outright. It is then bled by sticking a knife to the heart and it is immediately afterwards skinned.

METHODS CAN NOT BE MUCH CHANGED.

The methods of driving, killing, and skinning the seals are the results of many years of experience, and we do not see that they can be much improved. Whether brutal or not depends on the care taken in the details, which should be subject to constant supervision in the interests of humane treatment. Certain accidents happen, but they are of minor importance and do not affect the seal herd. The gregarious habit of the fur seal and his unwillingness to be left behind or even in the outskirts of the drove lead occasionally to overcrowding on the drives and killing grounds, and a few seals are smothered. Occasionally, also, on warm mornings, a seal becomes overcome* by heat or exhaustion and is unable to keep up with the drive. Such animals are at once killed and skinned, their pelts being recorded as "road skins." If left behind, most of these would recover and get back to the sea. Deaths from such causes are rare, only five "road skins" having been known to occur on the drives of this year, out of a total of 30,000 seals killed, besides the larger number driven up but rejected. It occasionally happens, also, that the wrong seal is clubbed by mistake. Such accidents seldom occur, however, as it is to the interests of the lessees as well as of the Government that only seals of the proper grade of skin are killed.

MOON-EYED BACHELORS.

The presence of seals suffering from blindness due to injury to the sclerotica—"moon-eyed" bachelors, as they are called—has been referred to as evidence of injuries received on the killing grounds. Occasionally an accidental blow with the club striking the eye will throw out the crystalline lens. This does not produce opaque sclerotica, however, but leaves an empty eye socket. Among the seals on the island this year not only were bachelors with such eyes found, but also cows and a considerable number of pups. These pups will in time, if they survive, return as "moon-eyed" bachelors or cows, and it is but reasonable to suppose that the adults with such defective eyes were originally blind pups. There is no evidence that the drives have anything to do with the matter. It is stated by Dr. Shute, an oculist consulted by us, that irritation produced by sand striking the eyeball or lodging under the lid is the probable cause of this disease, as well as of the sore eyelids often seen on pups.

CARE TO AVOID NEEDLESS PAIN THE ONLY ESSENTIAL.

The present methods of handling the seals, while they seem crude, are still effective and well adapted to the animals with which they have to deal. Any improvements that might be suggested are of minor importance. These may all be summed up in an injunction that scrupulous care be exercised in carrying out properly the various details of the operations as now conducted. Such care is now usually exercised and need never be wanting. Killing, of course, must be killing everywhere, but there are probably few shambles in the world where less needless pain is inflicted than on the fur seal killing grounds of the Pribilof Islands.

SHORTENING OF THE DRIVES.

Of late years the drives have been greatly shortened and now range in length from one-eighth of a mile to about a mile. This has reduced the strain on the animals, lessening the possibilities of smothering or death by exhaustion. None of the drives now made are long or trying. They bear no comparison in this regard to those on Medni (Copper) Island. For example, the longest drive on St. Paul, that

*From the deficiency of sweat glands and the presence of the thick blanket of blubber, the fur seals are readily overheated by exercise. They cool themselves by fanning with their hind flippers, on which the skin is thin, by breathing with open mouth, and especially by plunging into the water when this is possible. Internally overheating shows itself mainly by a slight congestion of the lungs, which, except in extreme cases, soon passes away.

from the Reef, is less than a mile in length, its greatest elevation 75 feet. The longest drive on Medni (from Palata) is some 2½ miles, its greatest elevation 1,220 feet. In Russian times, however, drives were made regularly from Northeast Point (Vostochni) to the village, a distance of 12 miles.* This may have resulted in pain and injury to individuals, but no harm to the herd could have come from it.

CHANGES IN INTEREST OF HUMANITY.

It can not be too strongly emphasized that all improvements in methods of killing and all changes tending to shorten or make easier the drive serve the sole purpose of avoiding pain and suffering. They do not affect the interests of the breeding herd. In general no practice connected with driving, culling, or killing has been at any time a factor in the diminution of the fur-seal herd. The severe drives of the Commander Islands, incomparably more harsh than were ever known on the Pribilofs, have not had the slightest appreciable influence in the reduction of the fur seal herd there. The treatment of the bachelors, whatever it might be, would affect the breeding rookeries no more than the treatment of horses on the London omnibus lines affects the royal stables.†

SEVERITY OF DRIVES.

As the severity of the drives on St. Paul has been a subject of considerable exaggeration in certain quarters and as a number of impossible results have been attributed to it, it will be well to consider the procedure somewhat in detail.

A DRIVE FROM THE REEF.

The following account of the Reef drive of St. Paul is copied from the field notes of Dr. Jordan and Mr. Clark:

"The drive from Gorbatch and Reef rookeries this morning (July 15) was witnessed by Dr. Jordan, Professor Thompson, Dr. Stejneger, Mr. Lucas, and Mr. Clark. Captain Moser and Lieutenant Garrett, of the *Albatross*, were also present. Mr. Crowley, Treasury agent, conducted the movements of the visitors. Fifteen Aleuts made up the driving party.

"We left the village at 2 o'clock in the morning. It was then light enough to make one's way without difficulty. After a few minutes' walk we reached Zolotoi sands, a beach about one-fourth of a mile from the village, at the angle of which the bachelors from Gorbatch rookery haul out to reach the rocky slope above. The drivers ran in quickly between the seals and the sea and soon had the animals rounded up in a large pod. From a similar hauling ground on the shore just across the neck of the peninsula another pod was in like manner rounded up. The two pods combined were left in charge of three men to be driven across the sands to the village killing ground a few hundred yards beyond.

"We then proceeded to the extreme point of the Reef peninsula. The hauling ground of Reef rookery lies in the rear of the breeding ground and has four well-marked runways connecting it with the sea, on which no harems are located. A line of idle bulls keeps clear a considerable space between the hauling ground and the rookery. From the head of the various runways and in the intervening space pods of sleeping bachelors were rounded up, the Aleuts passing between the idle bulls and the bachelors and turning the latter up the bank to the flat parade ground back of the hauling ground. Here the pods were all united in one large group and the drive started on its way. It was 3 o'clock when we reached the point and by 3.30 the drive was in motion.

"After passing over a short space of ground scattered at wide intervals with irregular bowlders and having a gentle slope, the drive came into the level grassy plain of the parade ground. Here the herd, which numbered about 1,500 bachelors, was separated into two parts for greater ease and safety in driving. While one pod was allowed to rest the other was driven slowly forward in the direction of the village. Three men were now assigned to each pod and the rest of the drivers allowed to return to the village to make ready for the killing. We followed the first herd.

"Over the green turf of the parade ground the drive moved along quietly and

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*The log of the island shows that in January, 1888, a drive of 500 seals was made from Northeast Point for food. Instructions were given to bring the drive in carefully and kill all seals becoming exhausted on the way. No record is made of any deaths. It is stated that the drive reached the village in good condition in two sections, the time being, respectively, 82 and 100 hours on the road.

†It will surely not be contended that the killing of a large number of males injures the virility of those not harmed.

without difficulty. The drivers took their positions one on each flank to repress any lateral movements and the third brought up the rear. There was no noise or confusion. In general the seals were allowed to take their own time and go at their own pace. Those in the advance acted as leaders and the rest of the flock followed naturally after them. At the beginning the seals showed some reluctance in leaving their hauling grounds and made ineffectual attempts to break away. But after the drive got under way they moved forward apparently as a matter of course. When the leaders showed an inclination to take a wrong course the men on the flank simply stood up and raised a hand, which was sufficient to turn them back into the way. For the most part the men kept out of sight of the seals.

"The seals on the drive do not keep up a continuous motion. They take ten or a dozen steps and then sit down like dogs to rest and pant, resuming their way when they find that their companions have gone on. The leaders set the example, and as they are rested by the time the rear members of the herd have come to a standstill, they move on and are ready to stop by the time the rear guard have started. The result is that some part of the herd is moving all the time and the progression is continuous.

"There is a tendency on the part of the young seals to go faster than the older ones, of which a large number were included. By a gradual sifting process the old fellows fell to the rear and on several occasions pods of from a dozen to twenty were cut off and allowed to return to the sea.

"All the seals and especially the larger ones showed signs of fatigue. They appeared to be hot and excited, and a cloud of steam rose constantly from the moving animals. This steam had a strong musky smell. When the herd stopped, individual seals would often sprawl out on the ground, raising their hind flippers and waving them fan-like evidently in an effort to cool off. After resting a moment the seals were ready to move on apparently refreshed. Continuous exertion is evidently hard on them, but they quickly recover from exhaustion. As soon as the flock comes to rest after a few moments' breathing they begin to bite one another and push in an unconcerned fashion until they are reminded by the absence of their companions that they must keep moving.

"The seals were not urged forward, but were allowed to take their own time. When the herd was brought to rest for a few minutes, the rear man started them on by clapping his hands or by rattling a stick on a rock. Our presence evidently urged the seals and made the drive really harder than it would ordinarily have been. The Aleuts seem to have a way of handling the seals that they understand.

"A short distance brought us to the end of the grassy plain and into an area of ground filled with embedded bowlders. These were for the most part flat and worn smooth. It looked like hard ground for the seals, but in reality they seem to get over it better than the flat ground. On the flat there was constant crowding, while here the rocks kept the seals apart. Besides the animals are more familiar with the rocky ground, their breeding rookeries with few exceptions being on the rocky beaches.

"After passing over a slight ridge where the passageway became narrowed by projecting cliffs and where there was a good deal of crowding and scrambling, the drive left the bowlder-strewn path and passed into a valley overgrown with tall Elymus grass and lying between rows of sand dunes also grass-grown. The seals seem to be refreshed by the moisture of the grass, which was wet with dew and rain.

"This grassy plain led into the top of the bowlder-set slope above Zolotoi sands, from which the earlier seals were driven. The seals passed down this slope without difficulty and came into the level sand flat. Here the first really hard work of the drive began. The seals seemed to find their greatest difficulty in walking on the yielding sand. Their flippers take hold of the rocks like rubber, but slip back in the sand. No rocks prevented the animals from crowding. They stepped on each other's flippers, became much excited, and seemed generally worried.

"But in a few minutes the sands were passed and the herd emerged into the grass-grown killing ground. As soon as the seals came to a standstill, they seemed to forget their troubles immediately. They began biting, snarling, and blowing at one another as though nothing had happened. They were at once turned into the little lake beside the killing ground to cool off and were then herded up on the bank to rest before their turn came to be killed.

"It was five minutes after five when the first herd reached the killing ground. The second arrived three-quarters of an hour afterwards, having taken more time on the way.

"Killing was already begun when we reached the ground. The Zolotoi seals, which had come in about 3 o'clock, having rested in the meantime, were killed first.

"The larger pods of seals were in turn separated into smaller ones containing from 20 to 50 each. These were driven up one after another and the killable ones culled out by clubbing them on the head; those too small or too large to kill were allowed to escape and were driven into the water. Some of these, released on the

eastern side of the peninsula early in the killing, had already made the circuit of the Reef and were again hauled out on Zolotoi in time to be included in the second herd driven in.

"The blow with the club on the head renders the seal instantly unconscious, and before the animal recovers it is bled by being stuck to the heart. The skin is at once taken off and thrown upon the grass to cool, the carcasses being allowed to rot on the field. The killing is under the immediate direction of the agent of the company and the native chief and in the presence of the Treasury agent. By a judicious division of the labor the various processes connected with the killing and skinning of the seals go on at once, and in a few minutes after the last seal is clubbed the skinning is completed.

"The total number driven this morning was 1,908, of which number 1,059 were rejected and 849 killed. Of the rejected seals 521 were too small and 538 too large to furnish skins of the requisite grade.

"From what has been said of the carcass-strewn roadways of the drives and the terrible effects of over-exertion on the seals, we were prepared to see greater evidence of exhaustion and to see the animals drop by the wayside to be killed and skinned there. Not a seal died by the way, and in half an hour the herd had apparently entirely recovered from the effects of the drive.

"The morning, however, was favorable for driving, the fog continuing and shutting out the sun. It is when the sun shines or the morning proves close and warm that the seals suffer. The sun seldom appears during June and July (the average for these months being less than a full day of sunshine in ten years), when the driving is done, and little difficulty is experienced."

This Reef drive on St. Paul is the longest and severest drive now made on the island. All the other drives are short, and with the exception of the drives from Tolstoi and English Bay, where the drives pass over short stretches of sand, the courses over which the seals are driven are level or slightly rolling and always grass-grown.

On St. George the drive from Staraya Artil is between 2 and 3 miles in length, with no difficult places, and small ponds at intervals, through which the seals are driven and allowed to cool off.

A DRIVE ON MEDNI ISLAND.

In order to appreciate the comparative ease of the drives on the Pribilof Islands, it is only necessary to contrast them with those on the Commander Islands. The following description of a drive from the rookery called Západni, on Medni (Copper) Island, is quoted from Dr. Stejneger's report for 1895 on the fur seals of the Commander Islands:

"The weather was just right for ducks and fur seals, and, consequently, we started out this morning at 6 a. m. in a drizzling rain. There was no help for it. The drive could not be postponed, and as I was going to photograph, rain or no rain, the cameras were taken along; the weather might possibly be better on the other side of the island, but it was not.

"As indicated yesterday, all the rookeries had to be scraped in order to make even a small drive, and since I could only be in one place at a time, I selected to go with the party taking the drive at Zapadni. Here altogether about 250 animals were finally gathered together and the driving started in three divisions. This could easily be done, for there were certainly enough people to attend to each division, there being no less than 30 full-grown men and about half a dozen boys. What a difference from former days, when two men or boys were all that could be spared for divisions of about 200 seals each! Most of the animals were killable bachelors, a few females and undersized bachelors having been separated out as the drive went on before the steep ascent was reached. Thus far I have only with certainty discovered one female driven across the mountain.

"The road was very wet and slippery, both from the long grass and the smooth clay, which here forms the chief material covering the underlying rock, and the ascent was, therefore, a very laborious one. The middle part of it is very steep, and in one place steps have been cut in the ground so as to facilitate the climbing. The altitude of the pass forming the highest point on this drive is about 760 feet.

"The seals soon commenced to give out, and the men resorted to all sorts of goading them on, short of killing, in order to get as many of the seals as possible alive to the killing ground at the village, since they wanted the meat badly. Only when a seal could absolutely go no farther, after having been urged on by being poked and beaten with sticks, only then it was killed and skinned; but not even then in all cases, for, if it was a small and therefore particularly tender animal, it was grabbed by the hind legs and dragged along until some steep declivity was reached, down which it was then flung. Yet a good many had to be killed along the road. Little girls and still smaller boys arrived now with big skin bags on their backs to carry

home the skins and choice parts of the meat. The last division, as well as about 100 seals from Palata rookery, reached the level ground behind Glinka village at 10 a. m., and were given a rest there.

"At 11 o'clock the final drive in four divisions was begun toward the killing ground near the beach (not 300 yards) west of the village. Down the steep embankment (fully 60 feet high) the numerous drives have worn a deep channel-like rut in the slippery clay, and down this chute the animals came rushing as if it were a toboggan slide. They slid down in bunches together and became piled up at the bottom in big heaps. As they were now driven over the sand of the beach a few undersized seals and a solitary matka or two were sorted out and allowed to escape into the water, but the final culling was done on the killing ground. Altogether 47 undersized animals were thus driven over the mountain and finally permitted to go back into the sea.

"These young animals let loose on the sandy beach afforded great sport for the younger generation of future seal killers—if seals there be left when they grow up. Four little tots, 5 or 6 years old, with sticks in their hands, tried to drive into the water two young seals too tired to advance farther and asking nothing but to be allowed to lie down and rest. The seals resented the attack, and the four little fellows hit them over the head and snout with their sticks, as they had seen their parents do with the big ones, and finally succeeded in driving them into the sea."

DRIVEWAYS ON MEDNI.

The following are Dr. Jordan's field notes of the driveways on Zapadni and Palata, made on August 25, 1896.

"Zapadni driveway: The drive from Zapadni goes up from the stony beach between two towers of rocks, climbing the gorge of a little brook which cuts into the bowlders and clay of the hillside, an excessively hard, rough little gully, very difficult for a man to climb, there being small cascades and wet clay in its course. The way is marked by road skeletons.

"After an ascent over ground of this sort for 300 or 400 feet, more or less, the drive goes up through steep grassy slopes, some of them of soft clay, somewhat cut into rough steps by men's boots. The general character of the ground is unrelieved, although more or less broken by cross gullies and ridges. The final ridge is 760 feet above the sea.

"On the Glinka side is a long slope, at first quite steep, everywhere grassy and rather easy, but marked with road skeletons, as it is very long. The rye grass grows longer below, and a little stream has deep depressions, which serve as death traps, as the skeletons show when the seals fall in piles one over another. Above Glinka is a steep slide of yellow clay, from which the village is said to have received its name. This slide must be a hard place for the seals. The seals (few in number) that are released because too young or too old are allowed to go down to the sea, whence they go back to the west side again.

"Palata driveway: The drive from Palata is now rarely made, as the seals have grown so few. They are killed all along the beach, and the myriads of flies about the decaying carcasses must be the source of great annoyance to breeding seals.

"The drive ascends from the parade ground on the top of the landslide. This was formerly occupied by bachelors. But there are no separate droves of bachelors now. They are scattered in little clumps about and between the rookeries.

"The drive then for about 100 feet ascends a grassy cliff so steep that steps have been dug in it to facilitate climbing. Then follows some 700 feet of irregular but very steep slope, in which the easiest depressions are sought, though the hill is everywhere about as steep as a man can climb, and one who goes up it must cling to the grass. Above this slope the drive reaches the back of the knife like ridge that separates Palata from Zapalata. This widens out into an easy level plateau for about 20 rods, marked with road skeletons. The elevation is 850 feet by Dr. Stejneger's map.

"Then follows a steep climb up gravel and clay, with scanty grass and heather, worn into steps, the driveway bounded on the southwest by a slanting precipice that lies above Sabatcha Dira. A steep shoulder of heather and small plants is followed by a final climb into the clouds to the summit of the pass, 1,220 feet above the sea.

"From the summit an abrupt descent leads down a distance of 500 feet by a zigzag trail as steep as a horse could pass over, strewn with gravel and covered with low flowers, to the bed of a swift little brook. This stream flows down into a grassy basin, the slope becoming less and less, the rye grass and putchki growing taller. At the junction of this stream flowing into the little brook to the west this drive merges into the one from Zapadni.

"The drive from Palata is not in any place so difficult as the gully just above Zapadni, but it is half higher and twice as long—a trip one could not take on horseback, nor would it be easy to lead a horse over it. Comparing it with conditions on

St. Paul, the Palata Pass is as steep as the cone of Bogoslof, twice as high, and is without water. Compared with the severest drive on St. Paul, it would stand as the ascent of Mount Blanc to a walk in the park. It is a very fatiguing trip for a man. It took me, walking rapidly, thirty-eight minutes (deducting stops) from Palata to the grassy level 860 feet; thence twenty-eight minutes to the top, 1,220; fifteen minutes down the upper slope, and fifteen more to Glinka."

And yet, notwithstanding the severity of the drives of the Commander Islands, no harm has resulted to the breeding herds of these islands from this cause.

EFFECT OF KILLING SEALS ON THEIR FELLOWS.

Among the evils of the process of killing the seals which have been dwelt upon is the abject fear and terror supposed to be inspired in the seal by the killing of his companions, the seals even "shedding tears." As to this we may notice that the males shed tears profusely when roaring or groaning in their ordinary affairs of life, these tears forming wet strips across the fur of their cheeks.

From field notes of Mr. Lucas we take the following:

"There is no doubt that the seals are frightened when driven up to the clubbers, but they have just as much fear of the boy who is guarding one side of a group of 1,000 seals as they have of the men who are about to knock them or their companions on the head. Their fear is instinctive and irrational, and is not due to any reasoning process or any dread of what is to come. It is largely caused by the discomfort of being crowded together. So little true fear do these beasts possess that the seals in a pod before the killers will snap at each other just the same as if they were being crowded by their neighbors in the hauling grounds. So far from being crazed with fright, when turned loose they are as liable as not to stop within 50 yards of the killing and there rest and scratch for half an hour.

"The stolid behavior of the seals on the killing grounds has long been remarked, and pitiful tales of their mad fright, being crazed by the sight of their slaughtered companions, and frantic efforts to escape are utter rubbish. The behavior of the first seal turned loose determines the behavior of the rest of the herd. If he hurries, the others hurry, and each one eggs on the other; if he stops to rest, all subsequently rejected stop to rest.

"Nor does the sight or smell of blood affect the animal more than a pebble or a piece of driftwood would.

"A bull was seen sniffing at a pool of blood without exhibiting either anger or alarm. Evidently so long as the blood was not his own it did not matter."

CHILLING OF SEALS.

"It has also often been urged that great loss of life ensues from the sudden chilling of overheated seals turned loose from their long drive and the excitement of the killing. But, intentionally or unintentionally, it is not stated that these seals have been absolutely quiet for half an hour to an hour, and that their "long drive" is in reality only 100 to 200 yards from the drove of waiting seals to the killing gang. Moreover, few of them return directly to the sea, for it is against the principles of a fur seal to do anything directly, the majority resting from half an hour to an hour before plunging into the water, which is not icy cold, but, like the air, has a temperature of 45° to 48° F."

AFTER EFFECTS OF THE DRIVE.

There is no evidence of any particular evil after effects of driving. The examination of many bodies on the killing grounds shows no trace of injury other than in a few cases a very slight congestion of the lungs arising from overheating. But three dead bachelors have been found on St. Paul this summer. This and other considerations show that the injuries resulting from drives, unless immediately fatal, are unimportant. A bull which can maintain himself on the rookeries is strong, virile, and capable of meeting any demands made upon him.

ALLEGED IMPAIRMENT OF VIRILITY.

There is not the slightest foundation for the supposition that driving impairs the virility of the bulls. This theory may have been based on the supposition that owing to the exposed position of the testes in the male animal they were liable to injury when he was in motion. The violent voluntary movements of the bulls on the breeding grounds would be sufficient answer to this supposition. But it is found as a matter of fact that the testes are under the control of the animal and are

withdrawn into the body cavity when he is in motion, thus being entirely protected from injury. Furthermore, for the first three years, or during the period when the bachelors are most liable to driving, the testes are retained in the abdomen, and only come down into the scrotum in the fourth year.

NOT WISE TO PROHIBIT CULLING OF DRIVES.

It would therefore not be necessary or wise to require the lessees to kill every fur seal they drive up. The skins of the "wigged" seals or half bulls are almost worthless as fur. To kill yearlings and short 2-year-olds would be extremely wasteful, as the value of the skin the following year would be much greater. If, however, the males were killed as closely as they should be, it would not be necessary to drive and redrive the half bulls and bulls as they have been driven this summer. The breeding grounds are now overstocked with bulls. When the need of a new supply of male life for the breeding grounds is felt, there should be reserved each year of the killable males a sufficient number to replenish the stock, all others being killed. The quota should not be a fixed one, but should represent all killable seals obtainable after the proper reserve for breeding purposes has been made.

HERDING OF CULLED BACHELORS.

It would be possible to herd the culled male seals in the Salt Lagoon and other bodies of water, if deemed advisable, to prevent redriving. These ponds could be fenced, and in them, as we have shown by experiment, large bodies of seals could be retained for two or three weeks or during the killing period. This would have, as matters now are, the more important advantage of saving them from the pelagic sealer. The females could not be thus herded without great danger to their pups, as without food the milk glands would become dry. If the driving were closed on July 20, much of the present culling would be avoided, as the great body of the yearlings arrive after that date.

INJURED BULLS.

There are to be found in the summer a certain small number of bulls, mostly young ones, which are away from the herd and which are apparently suffering. These have been described as "impotent bulls," "outcasts from the rookeries," "broken and spiritless victims of the drives," etc. Dissection of these shows that in all cases they have been injured in fights with other bulls or by pelagic sealing. A number of them have been shot for museum purposes. Among those examined, broken ribs, injured pelvis, hernia, broken flippers, dislocated shoulders, and gunshot wounds have been found to be the cause of their withdrawal from activity. Some of these were ambitious young bulls which ventured beyond their class. Most of them ultimately recover and return to their fellows.

CASTRATION.

There is only one record of an adult bull which was actually impotent. This one had been castrated by some accident. He had no "wig," but retained the full, soft fur of the 3-year-old. Judging from its effect on this animal, it was thought that castration might be practiced to a limited extent, at least, thus securing a larger and heavier grade of skin by allowing the animal to live until 4 or 5 years of age. Experiment, however, showed the matter to be difficult, and on a large scale perhaps impracticable. A pup taken from Lukanin rookery was castrated, the operation being performed by Dr. Otto Voss, the resident physician of the North American Commercial Company. It was skillfully and successfully done, and the pup, branded across the head to mark him, was returned in good condition to the rookery. Subsequent search failed to find him, dead or alive. It will be interesting to know whether he ever appears on the killing grounds.

The practical difficulty in the way of castration lies in the fact that the testes are under control of the animal and can be drawn up far into the inguinal canal. Experiment on a dead pup showed the organs apparently in a convenient location, but in the living pup it was necessary to cut very deeply and for each organ separately, thus making the operation long and tedious. An additional difficulty lies in the fact that the incisions must be made in an exposed place, where the wounds come in contact with the ground when the animal moves about. But doubtless the coldness of the atmosphere, the scarcity of microbes and flies, and the frequent plunges into salt water all favor the rapid healing of any wound on the fur seals.

XVII. MORTALITY OF ADULT FUR SEALS ON THE ISLANDS.

The following is a record of the adult seals found dead on the islands August 5 to 14:

Rookery.	Cows.	Bulls.	Bachelors.
ST. PAUL.			
Kitovi			
Lukanin	3		1
Lagoon	4	2	
Tolstoi	16	3	
Zapadni	16	6	
Little Zapadni	6		
Zapadni Reef	5	1	1
Gorbatch	5	1	
Ardiguen			
Reef	24	2	
Polovina	4	2	1
Vostochni	30	11	
Morjovi			
ST. GEORGE.[a]			
North	7		
Little East	1		
East	2		
Zapadni	2		
Staraya Artil	6		
Total	131	28	3

[a] Bulls and bachelors not counted.

In most cases the deaths in question occurred early, in the height of the breeding season, and the bodies when examined were so far decayed as to render an autopsy impossible.

The death of the bulls on the rookeries was no doubt in nearly all cases due to injuries received in fights with other bulls. The most common of these, cuts on head, shoulder, or back, are seldom fatal; but occasionally a deeper wound is made, producing hernia or suppuration and sometimes fracture of the ribs or pelvis. A dislocated shoulder or broken foreflipper would cause drowning. One bull was found blinded by buckshot in the head. The few bulls found dead off the rookeries are largely those injured by gunshot while on the migrations. Immature males and females are rarely found dead on the islands. Of the females found dead in the rookeries, nearly all are probably victims of the struggles of the bulls. A few have died in parturition, but here the cause of death is probably a bite in the small of the back by some bull attempting to form a harem by stealing cows. Two cows came in near Sea Lion Neck (Morjovi), North East Point, which had been shot by unknown poachers in July. There is evidence that others were thus shot. The following is our field record of cows which had been shot in July before the recognized opening of Bering Sea to the pelagic fleet:

"*Polovina, July 23.*—At the southwest end of the cliffs is a wet cow, just in from the sea, with bloody shot holes in her shoulder, the shot apparently having passed through. She was not killed and will recover.

"*Morjovi, July 24.*—A fresh cow also floated in to-day on the beach below Sea Lion Neck and was skinned by the guard. She had been lately killed by buckshot, there being bloody shot holes in the neck. Evidently pirates are already abroad. The carcass was examined. The cow was lean and in milk, but not much milk evident. Seemed to be an old cow from what I could tell by the ovaries, which were somewhat injured by the rude dissection of the skinner. I find shot holes through the œsophagus, in one side and out the other; also a shot hole through the glottis and one in the pericardium. The heart was full of clotted blood. The stomach was empty. The flesh is perfectly fresh, not more than two or three days dead. The cow died near the shore and was washed upon the beach. She was perhaps shot at some distance away and became worn out by long swimming. The skin was salted and taken in evidence of poaching from some quarter.

"*Morjovi, July 25.*—Another cow was washed on shore this morning near Sea Lion Neck. This one had been dead a day or two longer than the preceding. She was very fat and had a large unborn pup. A number of buckshot holes in the back and sides show the cause of death. This skin salted and retained in evidence of poaching."

Occasionally cows that have been speared come ashore. Some are mortally wounded;* others recover. One cow was found dead at high-water mark on Lukanin

* A cow was found dead at Vostochni that had been speared in the belly, then clubbed. Escaping from the sealer, she had been drowned in the surf on landing.

in September. A fish bone had lodged in her throat and pierced one of the veins of the neck. Her stomach was full of blood. She might have drowned or may have bled to death.

NO SPECIFIC DISEASES.

There is no evidence of any specific disease, epidemic, or malady among the seals. All recorded deaths of seals, old or young, are due to violence, starvation, or drowning.

XVIII. MORTALITY OF PUPS.

A. TRAMPLED PUPS.

The nursing pups found dead on the islands fall into two distinct categories: First, those which perish early in the season very soon after birth; second, those which starve to death after the middle of August because of the loss of their mothers at sea as a result of pelagic sealing. The deaths from other sources are so few as to cut no figure. These two groups may be separately treated.

Of the first category, those dying early, 11,045 in all were found on the two islands. Before the first week in August the ferocity of the bulls was such as to make it impossible to enter the rookeries or even to obtain a dead pup for dissection except on rare occasions, when, by means of a fish hook attached to a long pole a few outlying specimens were secured. On August 5 it was found possible, though with considerable difficulty, to enter the breeding grounds. On this date the count of dead pups was begun, and completed on August 12. The bulls, cows, and pups were driven off and every part of each rookery walked over and carefully inspected. The counting on St. Paul Island was done for the most part by Mr. Macoun, Mr. Clark, and myself. Mr. Lucas and Professor Thompson followed after to dissect and examine such carcasses as were in condition fresh enough to handle. The count of dead pups on St. George Island was made on August 16 and 17 by Mr. Macoun and Mr. Lucas, assisted by Colonel Murray. The count was extremely thorough, but must fall somewhat below the actual total for, while none were counted twice, some must have been overlooked or lost in crevices of the rocks.

Below are the counts of the two islands by rookeries:

St. Paul:		
Kitovi	109	
Lagoon	78	
Lukanin	205	
Tolstoi	1,895	
Zapadni	3,095	
Little Zapadni	134	
Zapadni Reef	104	
Gorbatch	712	
Ardiguen	2	
Reef	950	
Sivutch Rock	50	
Polovina	635	
Little Polovina	47	
Vostochni	1,808	
Morjovi	485	
Total		10,309
St. George:		
North	259	
Little East	31	
East	112	
Zapadni	199	
Staraya Artil	135	
Total		736
Grand total		11,045

This number found dead in early August on St. Paul was about 8½ per cent of the total number of pups (123,048). On St. George it was about 3¾ per cent of the total (20,023). The difference between the percentages on the two islands arises from the fact that the rookeries on St. George are smaller, less crowded, and contain fewer death traps. A greater number on St. George may have been carried off by the blue fox.

UNEQUAL DISTRIBUTION OF TRAMPLED PUPS.

The dead pups were found to be very unequally distributed. On the rocky rookeries, as Kitovi and Little Zapadni, on steeper inclines, as at the south end of Gorbatch, dead pups were very few in number.

DEATH TRAPS.

In the level tracts, and especially in sandy depressions or concave gullies, where seals were closely massed, the number was surprisingly great. Smooth areas, where the female seals are gathered in wedge-shaped masses, and where there are no obstacles to hinder the movements of the bulls and no rocks under which pups can hide, are recognizable as death traps. The worst death traps are on Tolstoi and Zapadni, but others exist on Polovina, Vostochni, Morjovi, Reef, and Gorbatch. The percentage of these early deaths from causes other than starvation ranges from one-third of 1 per cent (Ardigunen) to 13 per cent (Tolstoi sands) of the total number of pups.

For a clearer understanding of what is meant by death traps the following notes from the journal of daily observations may be quoted:

"*Polovina, August 10.*—The sandy area at the angle of Polovina rookery and leading back into the basin-like depression, hard and without bowlders, was an important death trap. The harems were here crowded together. Three hundred and fifty-six dead pups were found in this area."

"*Tolstoi sands,* August 12.*—The great area of hard, sloping sand on Tolstoi was found to contain 1,490 dead pups, the vast majority of them having been killed at the beginning of the season while the umbilical cord was still attached. Early in the season this region was covered so thickly with seals that they looked like a great swarm of bees. This part of Tolstoi is the densest of all the rookeries. It is justly called a death trap because it affords no obstacles to the movements of the bulls and no protection to the pups. The bowlders at the foot of the sand are no better than the flat itself, because of the downward pressure of the seals massed above. Where the dead pups are especially numerous was the center of the large wedge-shaped mass which reached out toward the angle of the sand beach where the bachelors haul out. Doubtless the effort of the bachelors in endeavoring to make a short cut to the sea is responsible for much of the fighting at this point. The uppermost portion of the mass of seals is protected by the ledge of rocks behind. Above the northernmost green cliff on Tolstoi are also many dead pups, the floor of the rookery being here made up of flat rock with occasional bowlders in place. There are many concave depressions, and the few bowlders are too far apart to offer much protection."

"*Zapadni, August 14.*—Next comes the so-called Zapadni gully, the most effective death trap for pups on the island. This is a long, winding depression, 1 or 2 rods in width, broadening at intervals and narrowest at the lowest part just before it spreads out into the broad sandy flat which lies above the rounded bowlders of the beach. All parts of this gully were filled with dead pups, but particularly that part just above the wall of green rocks which bounds it to the south. Very many dead pups were also found on the bowlders below, near the water's edge."

"In this depression in the height of the season much fighting was seen among the bulls, and there was no protection for the pups or hindrance to the movements of the bulls. In addition to this, bands of roving bachelors come down the runway at the upper end of the gulley and pass through the harems to the water. In the breeding season the entrance of a half bull in this gully is the signal for a general fight until he is thrown out at the lower end. The bachelors are tempted to use this runway because it is smoother than the ordinary way over the rocks. The gully and the sand beach below contained 663 dead pups."

EARLY DEATH OF TRAMPLED PUPS.

Of the pups here discussed the vast majority were killed in June or early July. Most of them had the umbilical cord still attached. It is evident that their death was caused by being trampled upon by the bulls while very young and helpless. Later the pups creep under the shelter of rocks or gather in pods about the rookeries or on the beaches, and the number killed by bulls is very much reduced. There is, however, among the earlier dead a certain number of large, well-nourished pups,

* In 1891 and 1892 large numbers of dead pups were seen on Tolstoi by Mr. Macoun and others, the number being estimated by Mr. Macoun at 4,000 or more. This estimate has been questioned, but it is not impossible even if no starved pups were included in the enumeration. There were then many more seals on Tolstoi, and, as the photographs show, harems extended farther out on the sands.

perhaps 250 in all on the two islands, which have been killed by the bulls at the age of from 2 to 6 weeks. Dissection of these large pups shows in most cases collapsed or congested lungs, occasionally ruptured blood vessels, broken skull, or other evidences of violence. But two cases of death by trampling were known to have occurred after August 10.

LOST PUPS.

In the early part of August a certain number of pups, perhaps 200 in all on both islands, were found to have died of starvation. Some of these were doubtless early victims of pelagic sealing. The greater part, however, must have been pups that had lost their mothers through the struggles of the bulls or by mischance at sea. Some had strayed from the rookeries beyond the call of their mothers to the hauling grounds or elsewhere. Within the confines of the rookeries themselves very few of the pups become lost, as both pup and mother soon learn to recognize each other's call.

DROWNED PUPS.

A few pups are drowned, but the number lost in this way is very small. On some rookeries exposed to heavy surf (Tolstoi and Lagoon) a few young ones not yet able to swim well are swept away or are caught in the crevices of the rocks by the rising tide and drowned before they can extricate themselves. As soon, however, as the pup is able to swim well, its adaptation to the water is so perfect as to enable it to frequent the sea at all times and in all conditions of weather with impunity. In the heaviest surf that broke on St. Paul in October thousands of pups were always to be seen playing in the breakers, and none were seen to be injured. The ability of the pups to take care of themselves in rough water has been underestimated.

Of 232 pups thrown up by the surf on the sands of English Bay about August 1, not one was found to have been drowned. They were simply trampled pups, which the surf of the storm of the previous day had washed down from the lower portions of the adjoining rookery—Tolstoi—the most crowded of all the rookeries. The "deadly surf nip," therefore, is a figure of speech, and drowning is a factor of very slight importance in the destruction of pups. A few drowned pups are, however, on record, and of the whole 11,045, possibly 200 died from this cause.

OTHER CAUSES OF DEATH.

A few other pups are injured by the bite of cows, by falling from cliffs, by the fall of rocks, by the pinching of rocks shifted by the waves, by being imprisoned in cracks, by inflammation of the lungs, kidneys, or intestines, and by unidentified accidents. The Burgomaster gull is almost constantly present on some rookeries. It devours the eyes of dead pups, and may occasionally blind or even kill a live one. The loss of eyes of four or five individuals is doubtfully attributed to this cause.

These matters will be discussed in detail in the general report by Mr. Lucas, who has the record of about 150 dissections. It should be remembered that only pups dying in early August were available for dissection. None of the early trampled ones could be secured until too far decayed, as it was impossible to enter the rookeries in July. The cases examined were, however, fairly typical, as pups were being born every day upon the rookeries while the count was going on, and conditions were practically the same as earlier in the season, except that the fierceness of the bulls had greatly abated at the time of the dissections.

The causes of death in the early part of the season may be thus roughly classified:

Trampled upon by bulls when less than 2 weeks old	10,295
Trampled upon when 2 to 6 weeks old	250
Starved to death	200
Drowned	200
Miscellaneous injuries	100
Total	11,045

The following notes are from the chapter on "The mortality among fur seals," prepared for the general report by Frederic A. Lucas:

"The appended list of autopsies gives the date of examination, the locality whence the bodies were obtained, and states by whom the examinations were made. In making them nothing was taken for granted, not even in cases of evidently starved pups, while all bodies found in situations where they might have been drowned were carefully examined to ascertain whether or not this were really the case. Care was also taken not to confuse marks made by the pecking of gulls with contusions, for such injuries about the eyes and frontal region, when inflicted shortly before or after death, may readily be mistaken for the actual cause of death. In two instances,

where the cause of death was not obvious and time permitted, the brain was examined, but in neither case did it exhibit any congestion or other lesion to account for death.

"Absence of fat, or of subcutaneous fat, may not mean as much as it should to those unacquainted with seals; in reality, it is practically synonymous with starvation, and if a seal lacks fat beneath the skin it is useless to look for it elsewhere. Fat is the seal's heavy undershirt, by which he is protected from cold, and when this is gone the seal is gone too.

THE STARVED PUP FROM ZAPADNI.

"In order that there might be no question as to the evidences of starvation, an active, healthy female pup found among the bachelors was placed by itself, its condition at various times noted, and an autopsy made after death. In order to have the same conditions that are found on the rookeries, the body was allowed to lie out of doors, exposed to the weather, for two days before it was dissected. The results of the autopsy agreed exactly with the diagnosis of starvation in man as well as with the appearances of the organs in other pups whose death was ascribed to starvation. When first taken, on August 1, the pup weighed 12 pounds; at the time of death, on August 15, the weight was reduced to 9 pounds. The appearance of the organs was as follows: Lungs small, flaccid, deeply congested; comparatively little blood in heart, and no clot; liver small, thin, and very dark; gall bladder full; much dark bile secretion in intestines, forming the 'tarry fæces,' so characteristic of starvation; kidneys small and dark; both branches of uterus congested.

THE CRUSHED PUP.

"It may be said, too, that a blind pup was killed on Zapadni by choking and crushing, much as might have occurred had the little one been sat upon by a bull, or trampled beneath a score of stampeding cows, and that the lungs showed the characteristic congestion found in the lungs of evidently trampled bodies.

AUTOPSIES OF DEAD PUPS SELECTED AS TYPICAL CASES BY MR. LUCAS.

POLOVINA ROOKERY.

[August 6. Examined by Dr. Otto Voss and D. S. Jordan.]

"No. 1. Male, large and well nourished; stomach containing some milk; pleural cavity contained about 1 gill of blood; lungs crushed and collapsed, dark purple with congestion; liver much contused; right kidney contused; other organs normal. Trampled.

"No. 2. Female, young, umbilical cord still present; well nourished; stomach empty; lungs crushed and congested, both lobes containing blood; heart much contused, its blood vessels congested; liver contused; kidneys and other organs intact. Trampled.

TOLSTOI ROOKERY.

[August 7. Examined by D. S. Jordan and F. A. Lucas.]

"No. 10. Female, in fair condition; slight contusion in upper lobes of lungs; liver and gall bladder ruptured; intestines stained with escaped bile; other organs normal. Trampled.

"No. 11. Male, in fair condition, a trifle lean; left side contused throughout its entire length; the left lung congested and flattened; other organs normal. Evidently trodden upon, pressing the left side flat.

"No. 13. Female, thin; no milk in stomach; head crushed; suture between frontals and parietals opened; all muscles of breast much contused; lungs, throat, and heart badly contused. Struck or trampled on.

"No. 14. Female, well nourished; born early in season, as fur is grayish. Found at water's edge, jammed between rocks. Right lobe of lung contused, but crepitating. Contusion probably due to contact with rocks. Water in lungs and windpipe. Drowned.

"No. 16. Female, recently dead, body still warm; absolutely no fat; lungs congested; liver thin and dark. Starved.

"No. 25. Male, found on sand; rather thin; skin and muscles about shoulders much contused; lungs badly congested; heart and aorta full of clotted blood. Trampled.

KITOVI ROOKERY.

[August 8. Examined by F. A. Lucas and D'Arcy W. Thompson.]

"No. 31. Female, fat; stomach containing nearly a quart of milk; lungs normal, crepitating; no bruises visible; gall bladder full of orange-colored bile; intestines full of dark, shining, fluid excrement; lower intestine inflamed. Intestine taken to village and carefully examined. Inflammation of bowels.

"No. 35. Male, in fair condition; lungs normal; liver also, the latter somewhat light in color (due to fat); gall bladder empty; intestines and kidneys normal; stomach empty, containing a few hairs. Cause of death not apparent.

REEF ROOKERY.

[August 8. Examined by F. A. Lucas and D'Arcy W. Thompson.

"No. 50. Female, good condition, fat; no inflammation of peritoneum; viscera normal, with exception of kidneys, which were soft and decomposed. Inflammation of kidneys probably brought about by a blow on the back.

LUKANIN ROOKERY.

[August 9. Examined by D. S. Jordan.]

"No. 55. Female, emaciated. Found dying, gasping and convulsed with spasms, and killed for examination. Stomach empty; no fat about body; viscera normal, but intestines full of dark greenish fecal matter. Starvation.

"NOTE.—The symptoms given above are those which have been ascribed to sunstroke.

GENERALIZATION.

"To sum up the evidence condensed in the two tables, it may be said that early in the season deaths are numerous, and are almost solely due to trampling. By the middle of August the pups are so large and the conditions have so changed that under natural conditions deaths are rare. For the great mortality which has prevailed of late years in August, September, and October, starvation, resulting from the killing of females at sea, is the sole cause.

"Another thing is also apparent—that contagious diseases play no part in the destruction of young seals. The only epidemic that has raged on the rookeries is an epidemic of quarrelsome bulls which sweeps over the breeding grounds with great regularity and remorseless severity.

Autopsies of 103 pup seals made between August 5 and August 14.

Cause of death not obvious	6	Drowned	14
Inflammation of lungs	1	Starved and trampled	7
Inflammation of kidneys	1	Starved	24
Inflammation of bowels	2	Trampled	42
Falling from cliffs	3		
Crushed beneath falling rocks	3	Total	103

Autopsy of 17 pup seals made between August 15 and September 8.

Inflammation of bowels	1
Trampled	1
Starved	15
Total	17

"The number of dissections might have been increased almost indefinitely by taking those pups which died of starvation after August 15, but after that date only two were seen which had not obviously starved to death. The 15 examined above were evidently starved, but they were dissected in order that there might be no question as to the cause of their death.

List of dead pups obtained for dissection.

St. Paul:		St. Paul:	
Lagoon	2	Zapadni	17
Lukanin	3	Tolstoi	36
Gorbatch	9	St. George:	
Polovina	9	North Rookery	1
Reef	13		
Vostochni	15	Total	122
Kitovi	17		

B. THE STARVED PUPS.

About the middle of August another and more important cause of mortality sets in. This is the starvation of pups through the loss of their mothers at sea.

PERIOD OF STARVATION.

The younger pups die in two weeks or somewhat less; the older ones in three or four weeks.

One of the largest and oldest pups on St. Paul Island, one which had already acquired its gray coat of winter, was found starved to death on Reef Rookery September 8 and was preserved in alcohol. The first starved pup definitely known to be the victim of pelagic sealing was noticed on Kitovi Rookery August 15. The last starving pup seen was killed for examination and measurement on the same rookery October 18. There were, however, very few starving pups to be seen on the rookeries after October 7, and only an occasional one after the 15th. On October 11 a thorough examination of the beach line of Reef Rookery on St. Paul, where 300 starving pups were counted on September 29, failed to show any remaining. Only 19 starving pups were counted on the rookeries of St. George Island, October 6.

After the pups have learned to swim well they spend most of their time in the water, often going long distances from the rookeries where they belong and not returning for days at a time. In the water they sleep, play with one another, dive like ducks, and toss about pieces of seaweed, sticks, and other objects that come within their reach. From these actions it has been contended that the pups were capable of finding in September and October other food than milk, and were therefore not likely to starve even if they did lose their mothers. With a view to settling the question, upward of a score of pups were killed on the rookeries of St. Paul during these months under circumstances most favorable to throwing light on the matter. (See record on page 33.)

CONTENTS OF PUPS' STOMACHS.

For the most part pups taken at random on the rookeries were found with empty stomachs. The few containing milk were either very full or nearly empty. Pups killed in the water or immediately after coming ashore were found without exception to be full of milk. All stomachs contained pebbles. In two stomachs, one full of milk, the other empty—that of a starving pup—small crustaceans were found. In the latter stomach was also a quantity of dry seaweed. The stomach of a starving pup scarcely able to walk contained a soft-shelled crab. In a stomach otherwise empty was a small tunicate. Several stomachs had bits of shells; many had shreds of seaweed. The foreign objects were found in stomachs well filled with milk as well as in empty ones. There was nothing in the examination to justify the supposition that the objects were swallowed with a view to deriving nourishment from them. They were doubtless picked up by accident or in obedience to the instinct which will ultimately lead them to catch fish. Interesting in this connection and apparently indicating that curiosity, and not desire for food, leads the pups to swallow these things is the fact that from the stomachs of the 59 bachelors killed for food on October 15 an identical collection of objects was taken. It could not be supposed that they fed on them.

EXCREMENT OF PUPS.

While considering the question of the probability of the pups feeding, the sand beaches of Zolotoi, English Bay, and Lukanin were found to be strewn with small cylindrical pieces of excrement evidently voided by the pups which were swimming by hundreds just off the shore. An examination of the rectum and intestines of pups killed in the water showed the presence of excrement of the same color and consistency as that seen on the shore. The presence of this excrement and the fact that only pups with full stomachs were found in the water, lead to the conclusion that the pups, like the older seals, go into the water to digest their food, the actions commonly mistaken for feeding being simply the outgrowth of their playful and inquisitive dispositions.

EVERY ORPHAN PUP STARVES.

The results of these examinations show that until as late as the 22d of October, or fully a month after the close of pelagic sealing, the fur-seal pups are wholly dependent upon their mother's milk for nourishment. It is probable that the change to a fish diet does not occur until after mother and pup leave the island in November. It may therefore be stated as a fact beyond question that every pup whose mother is killed at sea by the pelagic sealers must starve to death. To this there can be no exception.

COUNT OF STARVED PUPS.

At the time of the first count of dead pups in August, it was thought that in making the subsequent count of starved pups it would be possible to distinguish between the earlier and later deaths. But as the victims of starvation began to be added to the earlier dead pups it became evident that no such distinction could be made. It was therefore necessary in the second count to include all recognizable dead carcasses to be found on the rookeries. From this number the total of the earlier count could be deducted, and thus the deaths due to starvation found.

It was desired to postpone the second count as long as possible to give the pups time to starve. As the storms of September, however, began to be more violent the earlier carcasses began to disintegrate very rapidly, and accordingly the count was begun on September 28 instead of October 1 as at first intended.

As there evidently still remained a considerable number of starving pups, an effort was made to estimate them that they might be included in the count. Accordingly, Mr. Barrett-Hamilton and Mr. Murray, with native assistance, cleared the rookeries of seals in advance of the observers, driving them slowly into the water to afford an opportunity of counting the weak and dying pups. This count was necessarily unsatisfactory, but Mr. Murray and Mr. Barrett-Hamilton agree that it is to be considered an underestimate rather than an overestimate, and the figures are therefore not open to dispute.

The count of starved pups was made jointly by Mr. Clark and Mr. Macoun. With practically no exception every pup carcass was seen by one or the other of the two observers, and for the most part by both. Where the rookeries were wide, lines were stretched across dividing them in narow strips, which were traversed from end to end in making the count. Where the breeding grounds were narrow, the space was divided lengthwise between the two men, and with natives to help patrol the shore and outer edges the bodies were counted. The natives were not allowed to count but simply to point out the location of carcasses. Mr. J. B. Crowley, chief Treasury agent on St. Paul, was present during the entire count, and assisted in pointing out pups and directing the natives. The work of counting was completed on October 1.

It was evident, from the beginning, that some carcasses included in the count of August had disappeared through being drifted over by sand, washed away by the surf, or worn to pieces by the passing to and fro of the seals. It was agreed between Mr. Macoun and Mr. Clark that the matter should be kept in mind during the progress of the count, and if possible an agreement reached at the conclusion as to the necessary correction for the loss. It was mutually agreed that 20 per cent would cover the loss of early pups included in the first but not recognizable in the second count.

The total count of dead pups in the second enumeration was found to be 20,331. To this 20 per cent of the former count of 10,309, or 2,061, is to be added. The total number of starving pups counted was 1,527. A further addition of 150 must be made for dead bodies removed from the rookeries for dissection or other purposes after the first count but before the second. Adding these together, we have a total of 24,069. Deducting 10,309, the August count, the total number of starved pups for St. Paul Island in 1896 is found to be 13,760.

The following is the count in detail by rookeries:

St. Paul Island.

Rookery.	October 1, 1896.	
	Total dead pups.	Starving pups.
Kitovi	609	42
Lukanin	579	27
Lagoon	316	51
Tolstoi	2,449	191
Zapadni	4,395	154
Little Zapadni	693	64
Zapadni Reef	327	18
Gorbatch	1,878	126
Ardiguen	78	8
Reef	2,786	300
Sivutch Rock	284	31
Polovina	1,555	55
Little Polovina	119	22
Vostochni	3,313	329
Morjovi	950	109
Total	20,331	1,527

After waiting four days for an opportunity to get on board the vessel, the Commissioners were transferred to St. George Island by the revenue cutter *Bear*. On October 6 the count of St. George was made. Owing to the uncertainty of the landing, Mr. Barrett-Hamilton, assisted by Treasury agent, Mr. James Judge, made the count on East and Little East rookeries, while Mr. Clark and Mr. Macoun counted Zapadni, Staraya Artil, and North rookeries. The same methods were employed as at St. Paul.

The following is the result in detail of the count on St. George, the result of the count made in August being reproduced for purposes of comparison:

St. George Island.

Rookery.	August, 1896. Dead pups.	October 6, 1896.	
		Total dead pups.	Starving pups.
North	259	145	7
Staraya Artil	135	194	3
Zapadni	199	527	4
East	112	15	4
Little East	31	16	1
Total	736	897	19

FOXES ON ST. GEORGE.

The result of the count on St. George was a surprise and a disappointment. It was found that the blue foxes, which are very numerous and bold, had eaten all the dead pups. Only two whole carcasses were found on the island. It was necessary, therefore, to make the count from skulls, spinal columns, or skins. Very few of the pups belonging to the first count remained and the remains of the lately eaten starved pups were found scattered everywhere and chiefly away from the ground occupied by the seals. East and Little East rookeries seemed to have suffered the greatest loss, and there the work of the foxes was most thorough, probably because these rookeries, which are not large, are the only ones on the eastern side of the island.

A less number of pups were found in October on North, East, and Little East rookeries than were found in August. This does not mean that no pups starved on these rookeries, though it is possible that these rookeries suffered less from pelagic sealing from their position, facing the northeast. The explanation for the decrease on East, Little East, and North rookeries, and the only slight increase on Zapadni and Staraya Artil, is that the foxes had reduced to loose bones all the pups originally counted and nearly all of the starved pups as well. About 25 foxes were counted in and about the rookeries. There was no practical difference between the condition of the carcasses on Zapadni and Staraya Artil and those on the other rookeries.

ESTIMATES FOR ST. GEORGE.

The figures for St. George as they stand are not available for use or comparison. It is necessary, however, to form some estimate for this island. No fairer basis seems available than that of St. Paul. There it was found that the starved pups were 11.19 per cent of the total pups born. Applying this percentage to St. George we have 2,259, including the 19 starving ones, as the proportionate number of starved pups for this island, or a total of 16,019 for the two islands. This is 55 per cent of the reported number of skins obtained by pelagic sealers during the present season in Bering Sea. In addition to these nursing females the pelagic catch of course includes a certain percentage of those cows which lost their pups early in the season, and also a certain percentage of 2-year-old cows without pups but impregnated.

Not only will the rookeries next year and on succeeding years suffer from the loss of the mothers of these pups, but through the death of the females, one-half of the total number of starved pups, the evil effects of pelagic sealing will repeat themselves in 1899, when these pups should return to bear for the first time. The number of starved pups for 1895 and the preceding year must have been even greater. Thus pelagic sealing eats away the herd, compound interest being taken with every female lost.

The pelagic catch of the present season has been light, 29,398 fur seals having been taken in Bering Sea by 67 vessels, as against 43,697 in 1895 by 57 vessels.

PUP STATISTICS—SUMMARY.

Rookery.	Total born.	Dead.		Starved.	Starving.
		August.	October.		
ST. PAUL ISLAND.					
Kitovi	6,049	109	609	500	42
Lukanin	4,450	205	579	374	27
Lagoon	2,484	78	316	238	51
Tolstoi	14,439	1,895	2,449	554	191
Zapadni	17,648	3,095	4,395	1,300	154
Little Zapadni	4,200	134	693	559	64
Zapadni Reef	3,862	104	327	223	18
Gorbatch	9,142	712	1,878	1,166	126
Ardiguen	652	2	78	76	8
Reef	15,258	950	2,786	1,836	300
Sivutch Rock	1,907	50	284	234	31
Polovina	6,673	635	1,555	920	55
Little Polovina	1,363	47	119	72	22
Vostochni	27,148	1,808	3,313	1,525	329
Morjovi	7,773	485	950	445	109
Total	123,048	10,309	20,331	10,022	1,527
Addition of 20 per cent for loss between August and October counts				2,061	
Starving pups to be added as starved				1,527	
Addition for bodies taken for dissection				150	
Total starved				13,760	
ST. GEORGE ISLAND.					
North	6,809	259	145	762	7
Staraya Artil	2,269	135	194	253	3
Zapadni	5,509	199	527	617	4
East	4,086	112	15	457	4
Little East	1,350	31	16	151	1
Total	20,023	736	897	*2,240	19
Starving pups added as starved				19	
Total				2,259	
Grand total for both islands	143,071	11,045	21,228	16,019	1,546

* The figures herein given for starved pups on the rookeries of St. George are estimates based upon the conditions of St. Paul.

STARVED PUPS ON MEDNI.

It has been denied that the rookeries of the Commander Islands show a corresponding mortality due to starvation. On the rookeries at Glinka on Medni Island I found the conditions even worse than on St. Paul. The pelagic sealing is continued through July on the Russian side, and a larger percentage of the total number of females is destroyed. The following are my field notes on the subject:

"*August 25.*—Zapadni Rookery, of Medni Island, is a stretch of coarse shingle and rounded rocks on a sloping beach at the foot of very high cliffs. In the sea are large rocks, on which the female seals are now mostly gathered. On the shore are a small pod of females and a number of groups of pups. No males, young or old, appear.

"In the first little pod of 20 pups, 6 are evidently starving; 8 recently starved; dead ones lie there, and there are 4 dead ones of older date, but also emaciated.

"Zapadni Rookery seems not much larger than Little Polavina, of St. Paul. On the rookery ground are 11 fresh-starved pups, besides 14 which seem, some of them at least, to have been starved, but which are now largely decomposed.

"There are many carcasses of dead seals on the beach nearly devoured, and dense swarms of small flesh flies abound, their maggots destroying a dead pup or dead seal carcass very quickly. Evidently of the very earliest pups only fragments remain. The air seems drier and warmer than on St. Paul, and a dead pup remains fresh only for a short time. Many which have not been more than a week dead have been reduced to skeletons and hair.

"A pod of 46 pups on shore is examined. As a whole they seem much less active than Pribilof pups, smaller, sleepier, and more stupid. Seventeen of the number are evidently starving. Some look plump, but it is probable that nearly all of these land pups are really starving; the large and well-fed ones have taken to the water.

"Other pods show similar characteristics. In a group of some 200 about 80 are evidently starving. This is not a count, but a rough guess. The percentage in general holds for all groups examined.

"In this record no effort was made to get full counts for lack of time. I have only noted what I saw. It is very clear that the starving pup is in fullest evidence on the Glinka rookeries. On these rookeries trampled pups must stand at the very minimum because the rookeries are narrow and rocky, preventing massing, and bulls are few. There is little chance of drowning.

"One pup in the water has crawled upon a rock about 10 feet from the shore to die. The rising tide will drown him if he doesn't starve first.

"On the edge of the slide at Palata is a little brook which has worn a small gully and which is doubtless responsible for the slide itself. In the brook were 4 dead starved pups, and in a pod of 150 lying near it at least 50 more are starving.

"The governor of Medni Island seemed rather sensitive on the subject of dead pups, as though he felt that he might be taken to task for it. He spoke of the trampling of bulls as the cause. I tried to throw the blame on the pelagic sealers, and expressed my hope that wise arrangements might put a stop to the loss. But it would seem that the authorities think the less said the better on this subject.

"It is probable that most of the pods of pups along the beach are made up of starving ones, the strong ones being in the water and on the bare outlying reef. Even a fairly plump one seemed dull and dwarfish, while among the others are all stages of emaciation. The excessively numerous beach flies make quick work of the bodies.

"Separating Palata from Zapalata is a huge wall of cliff, at the foot of which, on the Zapalata side, is a number of parallel or knife-like reefs which extend well out to sea, bare at low tide, and now black with seals and pups, the females almost as dark as the young. The pups find excellent places for swimming between the reefs. A good many are scattered about over the slide which forms the rookery, mostly asleep, while many are crowded on the beach below.

"On the detached north end of Palata 42 dead starved pups were noticed, with 24 other dead ones mostly showing emaciation, but more than a week old, so that they can not be investigated. This rookery, like the others, is one on which very few pups would be trampled.

"One fresh pup, not emaciated, at the edge of the sea, has apparently drowned. This is the only pup seen in condition to be examined in which the death was obviously not due to starving."

AUTOPSIES ON MEDNI ISLAND.

The following autopsies are taken from my field notes:

"1. *Zapadni.*—Young male pup cast up by waves. Perfectly fresh; no trace of subcutaneous fat; lungs greatly congested, crepitate; no trace of water in him; heart normal, with some unclotted blood; liver very dark red; spleen purplish; stomach and intestines empty, except the lower part, which contains the dark-green tarry matter; gall bladder nearly empty; kidneys deeply congested, the left most so; evidently starved, not drowned.

"2. *Zapadni.*—Female; wholly devoid of subcutaneous fat; vent foul with black tarry matter; lungs deeply congested, not crepitating; intestines pale, empty, except for fluid brown bile; stomach empty, with mucus and bile; kidneys slightly congested, the left most.

"3. *Sabatcha Dira.*—Male; no subcutaneous fat; lungs excessively congested, almost black, not crepitating at all; heart normal, with some blood; liver very black; left kidney much congested, the right a little; intestines with tarry bile and slime in lower part only.

"4. *Sabatcha Dira.*—Male; lungs greatly congested, crepitate; no fat; liver dark; black matter in lower intestines as usual, the alimentary canal otherwise empty; kidneys congested, the right most so; heart normal, with some blood.

XIX. DAILY RECORD OF ROOKERY LIFE.

ARDIGUEN ROOKERY.

Between Reef Point and the beginning of Gorbatch Rookery there is a group of isolated harems, 27 in all, this season, containing 652 cows, which lie in a particularly favorable location for observation. The harems are scattered along the rocky beach for a distance of several hundred feet. Near the southern extremity a gully leads up and back to the level of the hauling ground of Reef rookery. In the gully itself and on the flat about its mouth are a number of harems. At the side of the gully toward Gorbatch the cliff rises to a considerable height and overhangs these harems, affording a view at close range without disturbing the animals. This section of breeding ground was under inspection at frequent intervals from July 14 until October 14. The place has been vaguely recorded as the "Slide" on the Reef. The Aleut name here chosen for it means "a pile of stones." The following

are the field notes on this rookery taken from the daily journal by Mr. Clark, Mr. Lucas, and myself:

"*July 14.*—Near the point of the reef are seven or eight harems, which lie at the foot of an overhanging cliff in a position favorable for observation. They will be visited as frequently as possible. The ravine in which they are situated is steep and rather deep, spreading out into a flat tract above. It is everywhere covered with large lava rocks worn smooth by the seals. The interspaces are filled with smooth gray lava sand. The seven harems designated for special study are known in order as A, B, C, D, E, F, and G. The first three are located on the level ground at the mouth of the gully. The others follow in order below.

"A contains an active bull, not very old, with 7 cows. One is a large gray cow with a greenish tint in her coat, due probably to sea water. She is just in and not yet dry. She is restless and the bull treats her very roughly, knocking her nose against the ground and making it bleed.

"The bull is now talking reassuringly to the cows who were alarmed on seeing me. He has a severe wound at the angle of his left fore flipper with the body. There are 4 pups in harem A. A pod of 16 pups are playing on the rocks between A and B. There are 3 more on the rocks above A.

"B is a larger harem. It contains 24 sleepy cows. There are 9 pups in the harem, 3 below and 24 playing between this harem and C. The bull in B is larger and browner than the one in A.

"C is a big harem on the flat rocks. The big black bull is very uneasy about a young 2-year-old bachelor whom A and B drove into his circle and who lingers there.

"Every time the big bull gets his eyes on him he dashes after him, but his attention is soon taken up with one or another of his many cows and the young fellow settles down in a different place in the harem. It is extremely difficult for me to pick him out among the cows, but the bull has no such difficulty. The cows snap listlessly at him and he is in a restless state most of the time, but seems unwilling to get away.

"There are 42 cows in this harem, perhaps another cow hidden. The bull has been taking a nap; he wakes with a roar and the little bachelor crawls over the cows, who snap at him. When the bull is quiet, the bachelor is also. The bull groans as if he had hard luck. The 2-year-old crawls into the upper part of harem D and the cows all bite at him till he perches on a flat rock alone out of their reach.

"There are about 25 pups asleep in C. Some are nursing. D contains a big brown bull with a long mane; 30 cows are with him and about 25 pups are scattered among them. Thirty-four pups form a pod between D and F, next to E.

"E has 10 cows and a younger bull of domineering disposition. Nine pups are asleep, nursing or scratching their ears, in E.

"F contains a big bull with 4 cows, nearly out of sight, as is also G opposite him with 16 cows. Four pups are about F and 20 about G, also 1 lone cow in the rocks asleep. A cow tries to leave G and go to sea; the bull seizes and carries her back bodily.

Summary of the typical harems.

Harem.	Cows.	Pups.
A	7	23
B	24	36
C	42	25
D	30	25
E	10	9
F	4	4
G	16	20
Total	133	142
Isolated pod		34
Total		176

"Some of the pups* must have come up from the rocks below.

July 15.—"At 3.30 a. m. the typical harems were visited. Two instances of copulation were seen at this time. The animals were as active as in the daytime. Of the pod of 38 pups 26 still remain. The harems have the same number as in the afternoon.

"In the afternoon the 'Slide' was visited again. Two half bulls were on the rocks above harem A. Harem B lies on a space about 36 by 30 feet. This would give an average of 45 feet each, no account being taken of space about them. They could

* When the count of live pups came to be made later on, it was found that the disproportion was due to the absence of cows at sea.

all be crowded into 480 square feet, if all were as closely packed as some are. This would give an area of 20 square feet each, or with pups, 10 square feet. This, however, could never be possible, and 23 square feet may be taken as a maximum in close masses, as True has estimated.

"If B covers 36 by 30, A to G cover 108 by 72, or 58 square feet; with bulls and pups, 24 square feet each; this is above the average for rookeries under the cliff, as 23 is a maximum in massed rookeries. True's estimate is not very far from correct, if rookeries could be measured.

"*July 16.*—A had 7 cows; B, 29; 1 afterwards proves to be the young male noticed at first visit to this point; the bull still after him. Driven out into the next harem, he finally works his way down and goes into the water. C has 43 cows, E has 25, and F has 16. There are other harems below, but they seem to have a fair proportion of pups at hand. But for these five harems, which contain 110 cows, there are 132 pups in sight. Thirty-eight of them are playing in a group above the highest harem.

"While counting the harems a cow gave birth to a pup very close at hand. Attention was first called to the event by a copious discharge of water from the cow, which ran down the rocky slope on which she was lying. The hind flippers of the pup were seen first. The cow was very uneasy, changing her position frequently, but chiefly keeping a sitting posture. In about two minutes, and apparently with no very great effort, the little fellow was born hind flippers first, evidently not the usual way. The mother quickly turned herself about, tearing off the cord and freeing the little fellow from his covering. She nosed over him, but made no attempt to lick or otherwise dry the pup. It almost immediately began wriggling about. The mother bleated over it like a sheep and seemed very much excited. A cow that was near by reached over, but was savagely snapped at by the newly made mother. The old bull came by and sniffed at the little fellow with a mild show of interest. The pup was on a slippery, slanting rock, and every movement it made caused it to slip down. The mother took hold of it by the neck just as a cat would take her kitten and dragged it up to her side. She would draw its head up to the teat, but it was some time before the little fellow made any very definite attempt to nurse. Later on it seemed to nurse. The mother seemed very anxious that it should do so. She finally moved up to a dry place and drew the pup up after her. A neighboring pup coming by was snapped at savagely by the mother.

"In another harem a cow was seen to pick up a pup by the back of the neck and carry it clear across the harem. Could not say whether it was her own or some other's pup. She laid it down and apparently paid no more attention to it, though the little thing remained near her.

"One cow in harem A seemed to have a cough. Every few minutes she would be doubled up with a fit of coughing.

"*July 17.*—A had 7 cows; B, 19; C, 29 only; D, 27. The young bachelor is not now visible. E has 9 cows; F, 6; G, 9. One in D is wet. The cows are asleep in indolent attitudes, but they waken occasionally and fight sleepily.

"The young bachelor has evidently returned. He is driven out of B into D by the angry bull. Wherever he goes the cows are in a turmoil and bite at him. He is now among the pups at the bottom of D. Passes a noisy cow, who strikes at him; tramples on pups of F and goes on dragging his hind legs over pups and upsetting them. He can be traced down to H, where he goes reluctantly, probably passing on to the sea.

"Away outside from C there is a big black bull, with a cow and pup, evidently a new harem. Call it X.

"The bull calf paddles down to the harem at the very foot slowly and reluctantly, trampling all the pups he can; they recover themselves rapidly.

"The old cow with the green fur, now silvery, formerly in A, is now in charge of an idle bull a rod higher up. Call him Y.

"*July 19.*—About 4 p. m. Cold and rainy. A has moved up 15 feet nearer the rocks and has 7 cows, his original number. Another bull from behind is located in his place, but has lost the cow he had stolen the other day from A's harem. We have designated him as Y. There is no difficulty in recognizing the cow by the peculiar shade of her neck, though now that she is dry this is not very marked.

"B has only 10 cows; C, 23, spread out and climbing on the rocks, probably because of the muddy condition of the harem, due to the rain. X has 1 cow and 2 pups. D's harem is much spread out, 15 cows. E has 3; F, 17; G, 2.

"Pups still being born, red placentas lying about. Cows much more scattered, probably to avoid mud. Pups podding.

"*July 20.*—The harems were visited at 5 o'clock. The day was very thick with fog, the wind blowing in with considerable force from the southeast. These harems were somewhat protected, all except those on the flat, C, B, and X. The following is the count to-day: A, 4; B, 6; C, 25; D, 14; E, 3; F, 17; Y, 0; X, 4. The cow with the peculiarly marked neck seems to be gone. Afterwards one wet cow from the sea comes up and enters in C, hunting for her pup.

"For the 73 cows now in the harems there are 192 pups visible. Of course, they may come up from the harems farther below,* and yet these, too, show a fair sprinkling of pups.

"*July 21.*—In the forenoon. Harem A has moved well up under the lee of the cliff with but 1 cow. Y remains in the old position of A, but with no cow.

"B has 5 cows; C, 30. X has 6 cows, growing right along. D has 11 cows; 2 of them show by their wet coats that they have just come from the water. The bull belonging to E is gone; 7 cows lie about the old position; F has 5 cows; G, 15, lying about asleep. The bull of E is seen lying down below G fast asleep; seems considerably cut. There is a wet cow climbing up to C. A pup ejects a quantity of cream-colored excrement.

"At 11 o'clock 2 cows come out of the water and move directly up the gully to the harems, where they arrive in five minutes. One cow ascends the rock, and seems in no hurry to find her pup. The other looks about and calls loudly, walks over one end of a solid mass of 30 pups, turns about so as to face them, lingers, then goes over to the outlying pups and noses some of them; snaps at them; comes back to the bunch of 30, noses over them, and snaps them as they wake up. At 11.17 finds a pup which she recognizes and allows to nurse. She then clears away enough pups from the rocks to make room, and sits up and dozes; appears tired and sleepy. The pup nurses, although the cow is wet. It shifts from nipple to nipple on left side.

"*July 24.*—A has still his 4 cows under the bank. X has none and maintains A's old position. Y, who had 6 cows at the last enumeration, has none to-day, but lies beside his rock with 2 pups. B has only 4 cows; C, 19. D has apparently 32, but part of them may belong to E, who seems to have been thrown out of his position and lies behind D. F has 15 cows. The number of pups still remains undiminished, but they are lower down the slide. A pod of 25 are down on the rocks so close to the water that the spray was breaking over them this afternoon. They were evidently there to meet the cows returning from the water.

"The pups on the 'slide' have all moved down somewhat. The pod of 38 pups originally which was on the level is now down in the gully.

"It is significant that the cow first noted with the greenish tinge on the neck is present again to-day, having been present on July 19, but absent on July 20. She has been absent four or five days, doubtless, at sea.

"*July 27.*—B has 5 cows and many pups. C has hauled back on the grass out of the muddy place where he belongs. There are 53 cows with him, evidently part of them A's. D lies alone below his place with 1 cow. Other cows are scattered along the muddy slide. A is asleep in his later place with 3 cows. E is gone altogether.† F is in his place with 8 cows. G is asleep away below; 9 cows are scattered about where he belongs. X has no cows and is above A's old place. Y is gone altogether, unless a lone bull on the edge of the cliff is he. The green-necked cow with her pup is with A. Two wet cows come in slowly and creep up the slide bleating very loudly, shaking their heads. There is nothing going on at the water front. The few wet bulls are inactive.

"A cow selects a pup from D and repels 2 others. A large pup comes from above down the wet slide to meet the mother and they crawl slowly up to D. Other pups look anxiously at each wet cow.

"*July 29.*—A is asleep with 2 cows on the flat rock, with a large pod of pups rolling and biting one another in the neck and flippers.

"B has 13 scattered cows, but spends most of his time in D, where a 'water bull' (Z) has come up and tried to establish himself, having apparently observed the disappearance of E. D is indifferent and half asleep down toward F, with whom he has a wordy discussion. D has 8 cows, and they squabble a good deal. A's green-necked cow is down in D. The water bull remains in E, where there are 3 cows. D is near him and orders him out, but both seem very sleepy. Twenty-eight cows are with C, who is pretty active. X is behind him with none. Y is well back, with 1 cow. Another bull well behind Y has 1 cow. Y is very fierce. Z, the water bull, lies back of C and D; he climbs up toward C, but the bull above growls and he comes down. F is active and has 9 cows. E is gone. Two weeks ago Z would have been skinned alive if he dared enter the harems as he does. He tries again to go up to C, who uses strong language.

"A is pretty lean. C makes a heavy lunge into a pod of pups and stands on the flipper of one, who pulls and pulls and can not get away until the bull moves.

"*July 30.*—The slide shows continual change. There are 58 cows up on the flat where the harems of B and C were located. Probably 35 of this number were in B's harem, but they stampede by way of C's harem, many of them going down over the cliff, but some of them almost immediately returning. On account of the stam-

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*See note to page 55.

† E was the first adult bull whose departure from his stand was noticed—July 27.

pede of the cows to the harems below it is difficult to determine the status of harems D, E, F, and G.

"A young 6-year-old bull (Z), noted yesterday as trying to locate himself in the slide, is now up above D and seems very active. He annoys greatly the cows trying to return to harem C, dragging them back down the slide as they climb the rocks. One cow has a particularly hard time. She bites him severely in the throat and on the back. The other bulls do not seem much inclined to tackle him. They are too lazy now.

"A is still under the cliff in his position with 10 cows. One gets away and is taken up by an idle bull above. He keeps the cow for a few minutes in the position formerly occupied by X. X has left his place and lies by the rock where Y used to be. Y is down by the brow of the cliff, a little farther along than the position occupied by an idle bull, which has kept his position from the beginning.

"In the cows now controlled by B there is a little brown one, very small; she looks very much like what one would expect a virgin* cow to be.

"*July 31.*—The 'slide' visited at 3 o'clock. One pup observed just born. Placenta still attached. Cow fairly large, but of the whitish color of those supposed to be young. Doubtless she is a 3-year-old, with her first pup. She is in charge of a half bull lately come on the water front. There are other cows in the harem. A cow draws up the pup to her breast by the nape of the neck.

"A large pod of pups are playing in the water. They seem to enjoy it greatly. Those entering the water are not confined to harems near shore. Wet ones are observed at the very top of the slide. One wet pup comes up to harem A. He waits a little and then goes back down the incline toward the water again. He is watched two-thirds of the way down. The wet pups are scattered all about in every pod of sleeping ones. They seem even smaller than their fellows, but probably this is because the water has smoothed down the fur.

"A wet cow just in from the water is watched for a few minutes. She calls; three or four pups answer. The cow ceases to call; probably she has heard her pup, and not wanting him until she is dry, she gives no further attention. No pup comes to her within half an hour.

"A mother lying near the large green rock awakens and calls. Her pup responds and comes to her. She is in a position which does not give the little fellow any chance. The cow fusses about, calling to the pup, who keeps up a response. Finally the little one is pushed off the rock and slides down 10 feet. The mother is alarmed and calls frantically. The pup comes to the foot of the rock and looks up, calling, but can not climb the rock. The mother calls repeatedly. Finally the pup makes a wide detour and gets up to the mother. She moves to a better place and the pup takes his dinner.

"The changes in the harems in the 'slide' go on. A has 10 cows. B has 6 cows near him, and probably 4 more at some little distance are under his jurisdiction. The harems are all scattered out in irregular fashion. Among his 6 nearest cows are 3 little white-breasted cows with dove-colored backs. They look like virgins. The other cows are brown and larger.

"The little cow, supposed to be a virgin last night and which was on the crest of the slide, appears to be about halfway down in another harem. She is brown, but very small, seeming to be the smallest cow seen. It is probable from her case that the light color does not necessarily represent difference in age, but rather individual variation in color.† It can hardly be possible that it means simply that the brown cow has been a longer time out of the water, as has been claimed. Have [G. A. C.] watched the rookeries from the time the latter explanation was first offered on July 8, at St. George. These light cows were present in numbers then, and they have been and are present in about the same proportion ever since. Some of them now on the rookeries are nursing pups as large and vigorous as any to be seen.

"C has 19 cows. X is gone from Y's place. An idle bull from the rear has taken his position—the old position of A. Y is still by the cliff's edge. X is lying flat in the edge of C's harem, which is crowded down toward the cliff. D has 20 cows, but can not be certain. The young half bull Z, seen to tease the cows trying to return from the slide to C's harem, lies sleeping in the place where we left him last night. There are 12 cows in the space formerly occupied by E, a different bull in charge. F and G can not be distinguished or counted with certainty.

"*August 2.*—A is still under the bank and has 4 cows, with possibly more out of sight. The green-coated cow is not in sight. B has 8 cows; C, 23. X is now in D's

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* Later observations show that she was a virgin 2-year-old.

† The true explanation seems to be this: The dark-colored cows, adult, come first. The white-breasted cows are all young and most of them late comers. But some even of the yearlings are brown underneath, like the old cows.

old place, and seems to control 18 cows; they are very much scattered. When last seen, X was in the outer edge of C's harem, on the flat. He has evidently fought his way down the slide or else has been thrown down by bulls B and C.

"The water bull Z seems to be comfortably settled with three cows. It lends dignity even to an undersized bull to give him a harem to take care of. E has 9 cows; F has 5. There seems to be a bull in G's place—perhaps he is himself back—with 10 cows.

"As we go round to the end of the reef the cows in C and B are frightened and stampede down the 'slide.' In ten minutes a half dozen are back on the flat. Doubtless all will be back in a short time. Y has disappeared.

"*August 6.*—B is down off the flat in the slide with 7 cows. He has evidently been down there since the time he and C were stampeded. C is on the flat still with 24 cows. A has 6 cows under the bank. There is a new bull from the top in a position between B's old place and A's original place. He has 3 cows. Y has 6 cows. X is down in the slide with 6 cows. The water bull Z has been driven out.

"*August 9.*—A is on his shelf, active and very lean; 8 or 10 cows. The old green-backed cow, often referred to, is there. B is in his place with 2 cows. C is active and holds 16. X is below A, with pups about him and 4 cows near. A new bull, very black, is in A's old place. Z is back with 4 cows, one very affectionate, lazily biting him. Eleven cows scattered below X. D is active, with some 10 cows or more. F is fast asleep with 2. E is out, and G. There are 31 bulls, not more than half seemingly old timers, on the whole of Ardiguen. There are 189 cows present, and 434 pups. This count, however, is not likely to be final, as it was made from the top of the bank, and there may be a large number of pups and a few cows hidden.

"Arduguen presents extremely favorable conditions for pups, there being apparently only 2 dead pups in the entire region. No bachelors run down in this slide, which is well provided with angular rocks. There is no hauling ground at Ardiguen, its bachelors going around on the parade ground of the reef.

"Three young bulls are still waiting patiently behind. Many of the cows in the harems are young females.

"*August 15.*—Fifty females in one harem, and two new harems started, presided over by 5-year-old bulls. The bull in charge of principal harem seems as active as ever—an old fellow. The original harems can not be distinguished.

"The gully leading down to the water is full of seals and pups. I do not notice any dead pups, for this highway to the sea is strewn with angular bowlders.

"While many of the seals present are 2-year-olds, still there are old cows present which from their actions may not have been pregnated as yet. Many of the cows are white and fresh looking.

"*August 23.*—But 1 bull, the oldest (C), is left of the harems at the head of the slide. A light rain is falling, and this part of rookery is deserted. The cows call their pups, but do not always take care to select a good spot for nursing. One cow sits on the rock in water where the sea at times washes completely over nursing pup.

"The young bull at the head of the slide is gone. The old bull seems to pay court to but 1 cow, and that the 2-year old. In fact, the 2-year olds are almost the only cows now looked after.

"From the way the pups play in and by the water it is more and more evident that we may get but a small proportion of starvelings; many will be drowned and, with others, may be washed away." (F. A. L.)

"*September 3.*—A's place is vacant; in it are 3 cows and many pups; all asleep. In B's place is a young bull asleep; no cows. Behind A's place is a sleeping black bull, probably one from behind; no cows. C has no bull; 8 old cows; many pups; no young cows about. Pups plump and large.

"The gully is full of old cows with pups. Three pups are now dead; a few more are starving; but most are very plump. About half the pups are wet; no wet cows. No bulls below except wet fellows by the sea Some wet cows come in; they move very slowly. One cow floods the place with urine.

"A young bull with 6 young cows lies well back from the mouth of the slide on the plain. Another bull is behind him.

"There is much excrement of cows and bull on the rookeries.

"A wet cow climbs to C; she calls loudly and pup comes at once.

"The rear edge of the whole Reef Rookery is now lined with hundreds of yearling cows more or less associated with harems of 2-year-olds, which are guarded by young bulls. The rookery extends far back from the sea. The starving pups are all game to the last. Some starving ones are grouped about, good for a week or so yet. Some starved dead ones are also to be seen; but these are not numerous as yet on the Reef.

"*September 6.*—Mr. Lucas counts 4 additional starved pups, making in all 15 to the present time. These have died within a week.

"A wet cow is seen to recognize a pup which looks as if he were half starved. He is very eager, but his mother is slow to give him a chance to nurse. The little fellow seems almost ready to eat her up. He fights off the other pups in the way, and keeps shaking his head and calling to his mother. Two other pups, plainly starving, are following the cow. These she drives off. This cow has probably been an unusually long time away. At last she climbs to a flat rock near the head of the cliff, pushes a pod of sleeping pups off from it, and, after much delay, she nurses her own.

"There are many starving pups in the 'slide.' The old bull in A's position still holds his ground.

"*September 18.*—About the head of the slide are 100 or more yearlings and 2-year-old bachelors, playing and chewing one another as at the other end of the Reef. The stream of bachelors extends down into the runway off Reef Point. There are cows and pups among them farther down.

"The big brown bull that has been in A's place is on hand to-day with the bachelors about him. Two young bulls are fighting near him. One of them seems very much excited and keeps up a steady roar. He remains while the other one withdraws. He sees me, and then watching me, keeps on roaring. He goes down into his old place, then goes out to meet the big brown fellow, and after a show of fight the big fellow moves away. The smaller bull is just in and dripping. As he dries, he begins to look familiar, and catching sight of his left fore flipper with its great scar, I recognize him at once as the original A of the slide back in his old place. His every action seems to proclaim that he is at home. A wet cow comes up with her pup and he rounds her up and talks to her. He moves about just as in the breeding season. This bull has not been about for at least three weeks and he comes back looking as if he had been away feeding.

"The big brown bull has gone over to B's original place, just as if he recognized A's right to the shelf under the rock and went home. He looks as though he might actually be B. (G. A. C.)

"A wet cow is coming up the 'slide,' calling loudly. A little gray pup, very thin and with a starved look, wakes up from under the big rock on the south side of the slide. He is at the top of the cliff and she is at the bottom, and it looks like a case of recognition. The little fellow sets out to climb down and slips, sliding head over heels to the bottom. The cow recognizes him and starts up the side at a place beyond, the poor little pup after her. He has to make many trials. He looks just like many of the pups we have been pronouncing doomed. The cow's ears are white. She wanders about and settles down on the flat stone that formed part of the boundary of B's harem. Her pup begins nursing eagerly. You can almost imagine you see his sides inflate.

"The brown bull starts B for the rock, drives off the cow, and settles down on it. She wanders off and the pup after her. Presently the bull starts after a cow. At once the cow returns with her pup. The bull comes back and gets on the rock. When last seen, he was lying on the rock and the cow sitting on an edge beside him, while the little pup stands in the mud.

"Returning by Zolotoi sands, I find that the half albino which was so conspicuous in the earlier part of the season is out again, wet. It looks as though these were home-coming days.

"There are at least 3 freshly dead pups in the slide. In one place there are 4 close together, all of which have died within a week. Two hopelessly starving little fellows are seen moving about. (G. A. C.)

"*September 19.*—Occasionally in different parts of the rookeries you find a bull in some particular place who seems not to have left it. They are generally in isolated positions. The black fellow that has been for the past two or three weeks at the head of the 'slide' is an example.

"There are more and more seals on the flat height of the parade ground. Cows and pups have moved back into the green flat at the eastern side on account of the rain.

"At the mouth of the 'slide' the bachelors are as yesterday. They have spread out over a good part of the little grassy hollow back of the mouth of the gully. There is a wet bull in C's place. He acts as though he owned the place, working industriously but ineffectually to keep out the young bachelors who are playing sikatch. He drives them all far out, then comes back and lies down, but they are back about him in a few minutes. The wet fellow goes over to make a lunge at the big black fellow and then does the same thing to A. Just the performance of the breeding season, but in a milder way.

"The bull at A is the original A without a particle of doubt. He is dry now and is recognizable by general appearance without his scar, but this removes any possibility of doubt. One would think that these old fellows knew us, they have seen us so often. They look up and roar. A is rounding up his cows and parading himself over his shelf just as in former days.

"A little gray pup, just able to move about yesterday, is now dead on A's shelf. The little half-starved gray pup noticed trying to find his mother yesterday is nursing to-day, and has filled out considerably, though he still shows the effects of his fast.

"The old black bull is lying on the rock from which he put the mother off yesterday. She is on another rock.

"There is a big wet bull coming up the 'slide' fresh from the water. He is in fine condition, and he toils up slowly. When he gets to E's place he goes over there roaring, routs up and smells of the sleeping cows. He then moves to the foot of the cliff near the big rock, roaring all the time. The black bull above gets off his stone and comes to the edge. They lunge at one another. The black bull goes back and the wet bull sits down in D's place. I will warrant he belongs there and is D himself, and that here are four of these original bulls back (A, B, C, D).

"*September 20.*—Several old bulls are in position on the edge of the reef. One is out in the surf with the pups before the 'slide' acting as though he would land. He did land in a few minutes, but went away again.

"A heavy surf is coming in here. The pups are evidently afraid of it. When they want to land they dive under a breaker and then come in in the spent water. When the returning water begins to let them down on the rocks and another breaker is coming behind them they turn about and dive out under it, coming up in the spent water and swimming in as before. Sometimes they have to go through the process several times. The old cows take a longer time than the pups and are decidedly cautious. The surf this morning is higher than I have seen it here.

"The bulls are lunging at one another and herding up the cows just as in the earlier days, but all their motions are mild and lacking in the old fire. They evidently realize that there is nothing to fight for.

"A cow is swimming about in the surf with a pup following her. It is evidently her pup. When they get separated she calls and the little fellow answers.

"*September 29.*—Ardiguen was found to contain 78 dead pups. There was 1 cow which was not noted in the previous count. One of the old bulls on the slide refused to go off and kept his position. On nearly every rookery some of these old fellows, returned from feeding, object almost as strongly to being moved now as at the height of the season. An hour afterwards, returning from the Reef, the seals are found back in their old places at the mouth of the slide. (G. A. C.)

"*October 1.*—The head of the 'slide' was measured, at Mr. Lucas's suggestion, and found to have a total area of 256 feet. Thirty-three cows and 4 pups were included. This would give an average of a little less than 8 square feet for each one.

"Three 'killers' are seen passing along the side of the reef in the direction of Otter Island. There is no special commotion among seals. They are evidently feeding, judging from the gulls alighting in their wake.

"Ardiguen is about as usual. Only 3 cows—no pups or bulls—on the flat above. One starving pup visible; has only a few days to live. The pups are very large here. Many of them are bigger in every way than the yearlings.

"It is plainly not true that all the pups turn gray. Many are now in color exactly like the yearlings—the brown ones. These pups are just as large and sometimes larger than the gray ones. There is just the same distinction in the pups as in the yearlings, and for that matter the cows themselves—individuality of color. (G. A. C.)

"*October 14.*—There are no bulls on the upper part of Ardiguen, and only 1 or 2 cows on the flat. There are 8 bulls lying at the water's edge, or rather teasing cows there, for they chase every moving cow that comes near and try to hold her. As a rule she hovers about a minute, biting gently at the bull's neck, and then edges off; the bull does not follow. The bulls have evidently just come back from feeding. They are in good condition. It is evident from their actions that if necessary they would be able and willing to serve cows.

"One of the bulls on turning about proves to be our old friend A, having his scar and general appearance. He has not been on his shelf since before the count.

"On account of the rain this morning the bulk of the seals were in the water. Those on land were perched on stones and holding their heads in the air." (G. A. C.)

XX. THE THREE FUR SEAL HERDS.

THE HERDS ENTIRELY DISTINCT.

The fur-seal herd of the Pribilof Islands does not intermingle in any way with that of the Commander Islands. The persistence of outline in the different parts of the individual rookeries indicates that the adult seals, male and female, come back not merely to the same island but as nearly as may be to the same place year after year. In a general way the males on the hauling grounds are proportionate to the females on the rookeries. When the bachelors are released from the killing grounds,

they frequently enter the sea at long distances from their original hauling ground, but there is every reason to believe that they return immediately to their own hauling ground, often passing others on the way. Many of the bulls after returning from feeding resume their old places on the rookeries, and the others haul out on favorite sand beaches, on which they rest in the intervals of feeding. With the younger seals this return as to place is doubtless less certain. But it is more than likely that the 2-year-old females and the yearlings of both sexes return to their home rookery.

DIFFERENCE BETWEEN HERDS.

There is, as has been noticed by various furriers, considerable difference in form, color, and appearance between the seals of the Commander Islands herd and those of the Pribilofs. The form of the Pribilof seals seems broader in the head and fuller in the neck and breast. The color of the females and young runs through various shades of warm brown, cinnamon, and silvery gray. The seals of the Commander Islands are sooty in shade, though varying from light to dark, but with little brown or silvery. The head and neck are more slender in proportion to the girth. The nails in the fore flipper are developed in the Commander herd, but rudimentary in the Pribilof herd, only a little pit in the skin marking the place of each. These characters are all subject to individual variation, but they will hold good of the herd as a whole. The fables of the colonization of the Commander Islands by fur seals from the Pribilofs at some comparatively recent date have no basis as knowledge. If the members of the two herds intermingle on any feeding ground, which is unlikely, each returns to its own islands.

Dr. Stejneger and Captain Moser further note that the fur seal of the Kurile and Robben islands, which constitutes the inshore herd of Japan, is likewise different from that of the Commander Isands in that the fur near the skin is quite white. No rookeries now remain on the Kurile Islands, the raiders having destroyed pups and all, on Mustr, Raikoke, and Srednoi, not more than 50 seals being now left. Only a few hundred are now on the Robben Island.

XXI. BRANDING.

BRANDING PUPS.

The recent experiments in branding female pups on the two islands will help future observers to record the movements of the cows. During the present season 124 pups and 2 cows on Lukanin Rookery were marked on the back with the following brand ⧺; on Kitavi 191 pups were branded across the shoulders with this mark, —, and on North Rookery of St. George 62 pups received this brand, ≡, and 9 cows this, ≣.

It may be here noted that branding is perfectly feasible. It does not seriously harm the pups, while it effectually destroys the value of the skin. Close watch of the branded pups on St. Paul Island was kept until the date of leaving. It was found that neither the wound nor the healed brand interfered with the relations of pup and mother. The salt water, while it had the effect of keeping the wound raw and uncomfortable looking, also kept it clean, and probably in the end hastened the process of healing. By the 1st of October, from three weeks to one month after the branding was done, the wounds had healed perfectly and the pups were as lively as their fellows. It was possible any day in October to count from 50 to 100 of the branded pups on Kitavi and Lukanin rookeries, and this was a fair proportion of the pups to be on land. At the time of the count of starved pups on St. George, 18 of the branded pups and 2 of the cows were seen, all in perfect condition. No dead ones were noted. On St. Paul only 4 branded pups are known to have died, and the rookeries were carefully searched for them when the count of starved pups was made. Two of the pups were killed—1 to furnish a specimen skin, 1 because it was starving. One of the others was plainly drowned, and the fourth was too far decomposed when found to make it possible to ascertain the cause of death.

Mr. J. D. Williams, of Brooklyn, N. Y., a member of the only firm making a business of dying seal skins in this country, gives it as his opinion that if a brand were to be applied to the back of the seal even so imperfectly as to leave no permanent scar or trace in the raw skin, in the process of curing the fur would doubtless come out, and the very fact that any class of seal skins were liable to this defect would cast doubt upon the whole lot and depreciate their value. This process of branding would therefore in itself, if necessary, put an end to pelagic sealing.

XXII. PELAGIC CATCH, 1896.*

AMERICAN VESSELS.

Vessel.	Catches.				Remarks.
	Northwest coast.	Japan and Russian coasts.	Bering Sea.	Total.	
Alton	99	547	175	821	
Anaconda		86		86	
Bering Sea	228		637	865	
Columbia	244		404	648	
C. C. Perkins	39			39	
Deeahks (Indian)	88		535	623	
Elsie		935		935	
Geo. W. Prescott	35			35	
J. Eppinger	1,376			1,376	
Jane Gray		483	8	491	Seized, Bering Sea, August 22, by Corwin.
Jas. G. Swan	120			120	Seized, Bering Sea, by Perry.
Jessie	140			140	
Kate & Anne	595			595	
Louisa D		534	154	688	
M. M. Morrell		639	265	904	
Puritan	24			24	
Penelope	250			250	
Rattler		649	289	938	
St. Lawrence		405	450	855	
Teaser	117			117	
Willard Ainsworth		724	204	928	
Indian canoes, etc	82			82	
Twenty-one vessels	3,437	5,002	3,121	11,560	

CANADIAN VESSELS.

Vessel.	Commander seal herd.		Pribilof seal herd.		Total.
	Japan coast.	Russian coast.	NW. coast.	Bering Sea.	
Ada				723	723
Agnes McDonald	545			282	827
Ainoko†			428	139	567
Allie I. Algar	659	48		411	1,118
Amateur			109		109
Annie C. Moore			431	1,088	1,519
Annie E. Paint	815			225	1,040
Arietis	1,034			438	1,472
Aurora†	360			77	437
Beatrice (Shanghai)			381	532	913
Beatrice† (Vancouver)			363	92	455
Borealis	327			305	632
C. D. Rand				569	569
Carlotta G. Cox	1,222			234	1,456
Carrie C. W			169	903	1,072
Casco	808	202			1,010
City of San Diego			213	400	613
Diana	997	95			1,092
Director	1,076				1,076
Dolphin			502	607	1,109
Dora Sieverd			377	826	1,203
Doris				662	662
E. B. Marvin	836			251	1,087
Enterprise	29				29
Falcon				340	340
Favorite			824	1,049	1,873
Fawn			428	614	1,042
Fisher Maid† (wrecked)			63		63
Florence M. Smith	602			271	873

*This table, furnished by Mr. Townsend, has been corrected to correspond with later advices received by the Treasury Department.

†Seized.

CANADIAN VESSELS—Continued.

Vessel.	Commander seal herd.		Pribilof seal herd.		Total.
	Japan coast.	Russian coast.	NW. coast.	Bering Sea.	
Fortuna	537	171			708
Geneva	499	451			950
Ida Etta	663			370	1,033
Kate			204	318	522
Katharine (foundered, 208 skins lost)	215				215
Kilmeny			100		100
Kitcahtla				50	50
Labrador			91	308	399
Libbie			502	593	1,095
Mary Ellen				536	536
Mary Taylor	383			137	520
Mascot	192			417	609
Maud S				602	602
Mermaid	940			345	1,285
Minnie			486	484	970
Ocean Belle	584			316	900
Oscar and Hattie			353	589	942
Otto	719			501	1,220
Ocean Rover				602	602
Osprey				200	200
Pachwellis			152		152
Penelope			458	897	1,355
Pioneer	893			375	1,268
Sadie Turpel	582			281	863
Sapphire			418	1,002	1,420
San Jose (wrecked, 4 skins lost)			230	605	835
Saucy Lass			471	555	1,026
Selma				185	185
Shelby				183	183
South Bend			70	359	429
Teresa	231			483	714
Triumph	606	20		750	1,376
Umbrina	742	41		298	1,081
Venture			269	442	711
Vera	572			264	836
Victoria			164	901	1,065
Viva*	607			70	677
Walter L. Rich			93	399	492
Zillah May				822	822
Indian canoes			2,353		2,353
Clayoquot store			98		98
Sixty-eight vessels	18,275	1,028	10,800	26,277	56,380

*Seized.

SUMMARY OF CANADIAN VESSELS.

Japan coast	18,275
Russian coast	1,028
Commander seal herd	19,303
Northwest coast	10,800
Bering Sea	26,277
Pribilof seal herd	37,077

RECAPITULATION.

Canadian vessels	56,380
American vessels	11,560
Total	67,94

PROPORTION OF THE SEXES.

The customs-house returns, as regards sex, are available for the American vessels. It has not yet been possible to obtain them for the Canadian fleet. The statistics for the American fleet are as follows:

	Males.	Females.
Japan coast	1,883	2,849
Russian coast	45	225
Northwest coast	287	3,150
Bering Sea	879	2,242
Total	3,094	8,466

According to these figures, 92 per cent of the Northwest catch and 72 per cent of the Bering Sea catch were females.

JAPAN CATCH.

A small catch was also made by vessels sailing under the Japanese and consular flags.

Golden Fleece	315
Silver Fleece	260
Josephine	60
Pointer	328
Chishuma Maru I	408
Chishuma Maru III	618
Kaiwo Maru	358
Nohi Maru	276
Total	2,623

ALEUTIAN ISLAND CATCH.

In the fall of the year, after the seals leave the islands, they are seen in considerable numbers in the bays and inlets of the Aleutian Islands, where a certain number of them are killed by the natives. The following is a record of the skins of fur seals taken in 1895, shipped from Unalaska on the steamer *Bertha*, July 29, 1896, kindly furnished by Mr. Stanley-Brown:

Locality.	Gray pups.	Females.	Males.
Chernofsky	381	4	8
Akutan	614	23	9
Makushin	180	2	.....
Morjovi	43	7	10
Unalaska	206	4	1
Sannak	4	1	.....
Total	1,428	41	28

XXIII. RESULTS ARISING FROM THE ACTS BASED ON THE AWARD OF THE PARIS TRIBUNAL.

CONDITIONS OF PELAGIC SEALING.

By the act of Congress and the act of Parliament, based on the award of the Paris Tribunal, pelagic sealing was recognized as legal, but subjected to the following restrictions, in brief:

1. No fur seals are to be taken within a closed zone of 60 miles distance from the Pribilof Islands.
2. No fur seals are to be taken at sea from May 1 to July 31, inclusive.

3. Only sailing vessels with undecked boats or canoes can be used in sealing.

4. Each sealing vessel shall take out a special license and shall fly a distinguishing flag.

5. Each master of vessel engaged in fur-seal fishing shall record in his official log book the place, number, and sex of fur seals captured each day.

6. The use of nets, firearms, and explosives in Bering Sea is forbidden.

7. The two Governments must see that men engaged in fur-seal fishing shall be fit to handle the weapons used.

8. These regulations shall not apply to Indians of either country using undecked boats of the usual sort outside of Bering Sea and not under contract for delivery of skins to any particular person.

9. These regulations for "the protection and preservation of the fur seals" shall remain in force until they have been in whole or in part abolished or modified by common agreement between the United States and Great Britain. The regulations are to be submitted every five years to a new examination, and to be modified if experience shows the need of change.

These regulations, nominally "for the protection and preservation of the fur seals," may be each briefly considered:

1. *Sixty-mile zone.*—The 60-mile closed zone affords no real protection to the fur seal. It does preserve the rookeries from invasion, and its establishment is of prime importance, both as preventing direct raids on the islands and as affording a precedent for real protection. A 10-mile limit could be easily invaded by canoes, but a 60-mile limit keeps all sailing vessels too far away. It is not likely that fur seals often feed within the 60-mile limit, and it is not certain that any more seals would be taken at a 40-mile limit from St. Paul than would be at a 100-mile distance. It is, however, evident that the radii of the movements of seals must converge as the island is approached. In any adjustment the patrol of some closed zone must be maintained.

2. *Open season.*—The most important part of the open season is now the month of August. In that month the greatest number of seals are on the feeding grounds in Bering Sea. There is less fog then than in June and July, and severe storms are rare. The conditions for capture of seals are more favorable. It is in August also that pelagic sealing can work most harm to the herd. The injury to the herd depends solely on the number of females taken. Whether these are killed in the spring when gravid with pup or in the fall to leave the pup to starve to death makes no practical difference. In September seals are abundant, but the autumn storms drive the schooners out from Bering Sea soon after the middle of the month. After the middle of August the skins become inferior through "staginess," incident to the change of fur. In general the bulk of the seal herd reaches Bering Sea early in June. June and July have not been regarded as good months for pelagic sealing. The needs of parturition and impregnation, with the rigid discipline of the harem system, keep about one-half of the females on the rookery for most of that time. Those going toward the islands probably do not loiter very much. In February, March, April and May the seals move northward along the coast and are taken at various points from California to Alaska. According to Mr. Alexander most of the old males winter in the Fairweather grounds in the Gulf of Alaska. Of the spring months probably May is the most favorable for pelagic sealing. This month is now included in the close season. As the seal herd is steadily diminishing, the spring or "Northwest Catch" is becoming relatively unimportant. In 1896 most of the sealing schooners were on the Japan coast in May and June during the migrations of the Commander herd, returning in July to Unalaska in time for repairs and to enter Bering Sea August 1.

It is reported that the Japan catch has been this year unprofitable, having fallen off half since last year. This is not surprising, as the Commander Island herd, which furnishes most of this catch, has been rapidly declining in numbers. It has suffered from pelagic sealing much more severely than has been the case with the Pribilof herd. At its best the number of seals on Bering and Medni islands was about half the number found on St. Paul and St. George. The Commander herd is at present certainly less than one-third the size of the Pribilof herd.

No change in the present close season nor in the regulations connected with it, not even if involving the closure of Bering Sea, would be effective in saving the herd if pelagic sealing is permitted at all. The maintenance of the herd demands the prohibition of indiscriminate killing. No final settlement is possible except on the basis of the amicable surrender of the right to kill fur seals at sea..

3. *Steam vessels not permitted.*—The requirement that only sailing vessels shall be used is in the interests of small shipowners. Steam craft would lose less time, but as the work of sealing is done in canoes, there would be no great advantage in the use of steam vessels, especially in view of the price of coal at Unalaska.

4. *Special license and flag.*—The minor requirements of a special license and a special flag for sealing schooners are, of course, convenient for purpose of record or recognition at sea.

5. *Statistical records.*—The requirement of statistics as to localities of fur seals taken has some value in determining their distribution in the sea. The requirement that the sex shall also be recorded is farcical. Such information if obtained would be valuable, but it can not be gained in this way. Masters of vessels will not put themselves out to give accurate statistics if it is believed by them that to tell the truth would be against their own interests. As to this, Mr. A. B. Alexander has the following pertinent remarks:

"It has generally been supposed by most sealers, and the view is still entertained by many, that if it were known that a greater number of females than males were taken it would greatly affect and possibly restrict their privileges when the time came for a readjustment of pelagic relations. The fact has generally been lost sight of that the condition of the rookeries at the end of five years will have the most weight in deciding the matter.

"That pelagic sealers should pay little attention to the sex of the seals taken was but natural, as they had no object in determining which sex predominated, the thought uppermost in their minds being to capture as many seals as possible."

For example, according to Mr. Townsend, the schooner *Stella Erland* reports in her log 83 males, 82 females. The customs examinations showed 130 females, 35 males. The *Teaser* reported 41 males, 46 females. The customs officers found 23 males, 64 females. Similar discrepancies occur in the log books of many other vessels. Even where an attempt is made to make an honest record, all fur seals not in milk are recorded as males, as it is not easy to distinguish the sexes except by direct inspection.

The Canadian sealers are this year further required to note also the "barren females." As the sealers have neither means nor time to look for the minute fetus present in August, all cows not in milk nor obviously gravid must be recorded by them as "barren," if indeed they take the time to observe the sex at all. The barren female of the fur-seal herd is an imaginary being. Yearlings, 2-year-olds, and cows who have lost their pups early, will seem to be barren.

6. *Prohibition of firearms.*—Through the prohibition of the use of firearms in Bering Sea, fur seals are killed by the spear and club. This arrangement is supposed to give an advantage to the Indian hunter who has long been expert in the use of the spear. White men soon become with practice equally skillful. According to Mr. Alexander, the white hunters are at this disadvantage: They are employed also as sailors, while the Indians, being useless on shipboard for any other purpose, give their whole time to hunting. The white hunters have the advantage of greater persistence. The Indians are readily discouraged by bad weather and bad luck.

When fur seals sleep after feeding, as is often the case in Bering Sea, they can be more surely taken with the spear than with the gun. The noise of the gun moreover alarms others in the vicinity. Traveling seals are probably more readily killed with buckshot, and doubtless if guns and spears as well could be used in the canoes more seals would be captured. With the shotgun the number lost after being mortally wounded is vastly greater than with the spear. Without attempting to discuss the vexed question, it is safe to say that the number actually secured by shooting is very much less than the number killed. The capture of 1,000 skins through the use of the shotgun represents a much greater loss to the seal herd than the same number taken with the spear. A considerable number of the living seals on the island carry buckshot in their bodies. Some speared seals also escape, as seals with spear wounds and also with spearheads in the skin are occasionally seen on the islands. The tenacity of life in the fur seal is extremely great. Unless hit in a vital part it is able to swim a long distance even when severely wounded.

American sealers are now required to have their firearms sealed by the customs officer at Unalaska. No such requirement is made of the Canadians. This discrepancy is unfortunate for the latter, as the possession of skins of fur seals which have been shot exposes their vessels to seizure. The absence of firearms unsealed would in such case afford a strong presumption that no violation of law had been committed. The failure of the British authorities to make this obviously reasonable regulation is the source of some ill feeling among the sealers themselves.

The refusal of the British authorities to permit examination for shot skins and for sex to take place in the customs offices instead of on the decks of the schooners seems to us a serious error, involving great inconvenience to the patrol vessels, as well as to the sealers themselves, as the patrol officers could not undertake the repacking of opened cases or casks of salted skins.

7. *Skill in use of spear.*—The regulation requiring each fur-seal hunter to show that he has the necessary skill to use the spear is valueless and borders on the ridiculous.

8. *Use of open canoes.*—The privilege of fur seal hunting along shore in undecked canoes has long been exercised by the Indians of Barclay Sound, Neah Bay, and other localities. This article provides for the continuance of this privilege under the old conditions. The Aleuts of Unalaska, Unimak, Akutan, and other islands have, however, been included under the provisions of the Paris award and are forbidden to

exercise the same right during the closed season, it being supposed that in these waters it would be possible to destroy larger numbers of seals than can be taken by the Indians on the northwest coast. This is apparently not the case, and there is no good reason for this discrimination.

9. *Revision of regulations.*—The really important clause in the award of the Paris Tribunal is that which relegates the matter after five years to the authorities of Great Britain and the United States, giving these nations, vitally concerned, the right and duty to protect the fur seals in case the regulations already adopted fail in this regard.

PATROL OF BERING SEA.

The acts of Congress and of Parliament, in connection with the award of the Paris Tribunal, make necessary the joint patrol of the North Pacific and Bering Sea by vessels of the United States and Great Britain. The work of the patrol in Bering Sea is in the highest degree difficult, onerous, and expensive. This work has been performed with the greatest faithfulness, so far as the United States is concerned, by the admirably organized revenue-cutter fleet under the competent direction of Capt. C. L. Hooper. How unpleasant and even dangerous is the continuous cruising in this rough and foggy sea those who have not visited this region can hardly appreciate, while the examination or seizure of schooners belonging to men too ignorant or too careless to heed the restrictions laid on them by the Paris Tribunal is a task extremely unpleasant. The results are not worth the costs, as regulations not in a high degree self-enforcing are useless to the fur-seal herd. The patrol fleet for 1896 has consisted of the revenue cutter *Rush*, Capt. W. H. Roberts; *Perry*, Capt. H. D. Smith; *Corwin*, Capt. W. D. Roath; *Grant*, Capt. J. A. Slamm, and *Wolcott*, Capt. M. L. Phillips. Of these vessels the *Corwin* was assigned to the 60-mile zone. The region patrolled by the other vessels has been divided into four quadrants, the vessels being assigned to one or another from time to time. Neither fur seals nor sealers have been found in the northeast quadrant. For Great Britain H. M. S. *Satellite*, *Pheasant*, and *Icarus* have done the duties assigned them, under the direction of Capt. A. C. Allen. Each of the American revenue cutters has cruised in the North Pacific and about the Pribilof Islands, covering in the aggregate about 70,000 miles, the cost of coal alone being about $35,000. Seven vessels supposed to be violating the regulations have been seized. Of these five (*James G. Swan*, *Ainoko*, *Viva*, *Beatrice*, and *Jane Gray*) were found within the prohibited zone, one (*Aurora*) had shot skins on board, and one (*Sitka*) had neither special flag nor license. The *Kate*, seized for having two skins containing shot holes, was released, having no firearms on board.

CLOSING OF BERING SEA.

If a close season were so limited in time as to virtually close Bering Sea, and the custom houses of Great Britain and the United States were to cooperate in the work of patrol, it could be performed by fewer vessels, and possible seizure of schooners for unintentional irregularities would be less likely to occur. So long as *pelagic sealing* is permitted, however, under any regulations, it will run its course and cut its own throat. This is only a question of a year or two, more or less, whatever the regulations controlling it. Of the present restrictions, the sixty-mile zone and the closure in May, June, and July only, are worth the cost of enforcement. It is not necessary to search the seas to find vessels in the close season if the customs houses prevent their clearance at that time. The examination of skins for shot holes should be made at the customs houses by experts. The deck of a schooner in a southeast gale is not the place for such investigations.

HOPE OF PERMANENT ADJUSTMENT.

That the way is open to a permanent, honorable, and amicable adjustment the present writer does not doubt. The facts in the case no longer admit of cavil. The high character and unquestioned ability of the commission of investigation appointed by Her Majesty's Foreign Office in 1896 afford a guarantee of judicial fairness in any future action of the British Government.

NO SETTLEMENT FINAL IF PERMITTING PELAGIC SEALING.

In any event, this is certain: No settlement not the right one can be final. This final settlement will not be hastened by indirect attempts to save the fur seals by limiting pelagic sealing while still legalizing it. To call names will certainly not mend matters, rich as the vocabulary of our indignation may be. If the Paris Tribunal was in error in its conclusions or in its regulations its mistakes are not necessarily fatal. Their attempt at compromise is only an episode, not a

settlement. The sole possible basis of adjustment must be the protection of the fur seals through mutual concession,* international courtesy, and self-respect.

So long as pelagic sealing exists the restrictions governing it are of slight importance, and the relations between the owners of the Pribilof Islands and the nations whose ships have the right to destroy its herd must be in some degree strained.

The ultimate end in view should be an international arrangement whereby all skins of female† fur seals should be seized and destroyed by the customs authorities of civilized nations, whether taken on land or sea, from the Pribilof herd, the Asiatic herds, or in the lawless raiding of the Antarctic rookeries. In the destruction of the fur-seal rookeries of the Antarctic, as well as those of the Japanese islands and of Bering Sea, American enterprise has taken a leading part. It would be well for America to lead the way in stopping pelagic sealing by restraining her own citizens without waiting for the action of other nations. We can ask for protection with better grace when we have accorded unasked protection to others.

As to this, Mr. Hamlin has made the following strong statement,‡ which I fully indorse:

"Before the Paris award our counsel contended pelagic sealing was an inhuman and immoral pursuit. By that award it was legalized, so to speak, and both Englishmen and Americans were allowed to take part in it. I believe firmly, however, the United States Government should prohibit pelagic sealing by its own citizens. I think it ought to go into this controversy with clean hands. It is an immoral pursuit; 75 per cent of the seals killed at sea are females; 75 per cent of the females killed are heavy with young or (and also) have pups on the islands. Their young thereupon die with them or starve on the islands. It is an inhuman butchery, and I believe it is the duty of the United States to stop it as regards at least its own citizens.

"Of course the criticism is at once made that if we do that it would leave it open to Englishmen as a monopoly, but I still feel, in spite of that, we owe a duty to humanity to put an end to it as regards our people and then proceed as best we can to have it discontinued by Englishmen. I feel very strongly and very keenly that until we do that we do not enter this controversy with clean hands. It was our whole case abroad that the butchery was inhuman; that it was simply torturing females, and the whole moral sentiment of the world is against such cruelty to dumb animals. * * * I think it would be most desirable to have such a prohibition enacted into law."

THE SEA OTTER.

A closed zone should be extended by international agreement about the Trinity Islands, Sannak Islands, Chirikoff Island, and the seas about other islands inhabited by the sea otter, and provision should be made to insure the sea-otter herds of Alaska from destruction. The sea otter can only be protected by international agreement.

PROPOSED SLAUGHTER OF THE SEAL HERDS.

I may here express my feeling that the monstrous proposition to destroy the seal herd because it has been injured by pelagic sealing ought not to be considered for a moment. It would be a confession of impotence unworthy of a great and civilized nation. Its result would be to transfer to ourselves any odium which has deservedly fallen upon those who would recklessly destroy a most useful and a most interesting race of animals.

If extreme action be thought necessary the safe and effective method of branding the female pups could be tried. But this ought never to become necessary.

DAVID STARR JORDAN.

PALO ALTO, CAL., *November 7, 1896.*

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*In this connection, we may note that the average price of pelagic fur-seal skins in London is about $8 each. From this the cost of capture and transportation is to be deducted. The average value of the female for breeding purposes under proper protection would be about $40 to the owners of the islands. The value of pelagic skins is only about half that of skins taken on land. This difference is due to their lack of uniformity, the staginess of those taken after the middle of July, the presence of shot or spear holes, and the inferiority of the methods by which the skins are preserved.

†There is no difficulty in distinguishing the sex of salted skins, if proper care be taken. Female skins are best known by the presence of the nipples.

‡ Hearings before Committee on Ways and Means. (Dingley bill, 1896, p. 8.)

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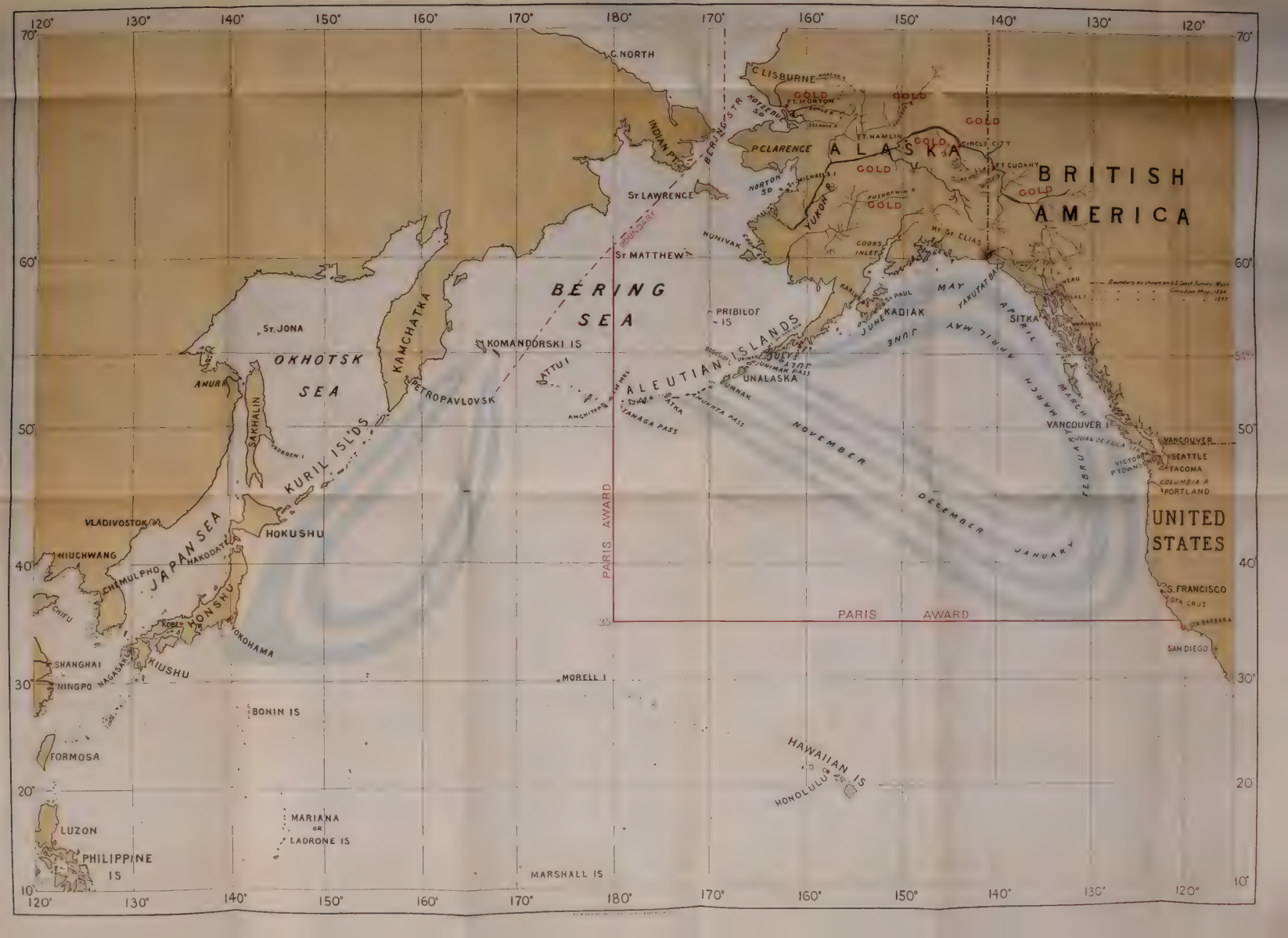
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LUZON
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FEBRUARY

OBSERVATIONS

ON THE

R SEALS OF THE PRIBILOF ISLANDS.

PRELIMINARY REPORT

BY

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